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32nd Annual

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and

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SEPTEMBER 6-11, 1954

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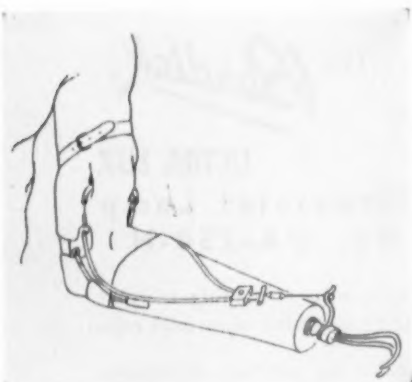

FIG. 1. Below-elbow cineplastic prosthesis with cables and terminal device fitted.

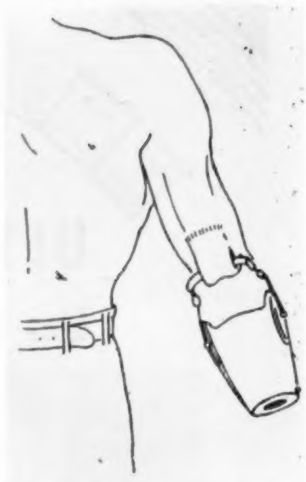

FIG. 2. Showing below-elbow prosthesis on stump with muscle tunnel pin in place.

Whatever your interest or problem in appliances suitable for cineplasty or any phase of arm prosthetics, we are anxious to cooperate in every way possible. Please contact our local, or nearest, representative at any time.

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Under His Foot, the Live Grenade

THE MACHINE GUN belonged to E Company, Second Battalion, Seventh Marines. It was under the command of Technical Sergeant Robert Sidney Kennemore.

It was busy. For on this November night fanatical Red masses were swamping Marine defense positions north of Yudam-ni.

Fighting was close and desperate. Fifteen yards in front of the gun, a Red soldier raised his body briefly and sent a grenade into the air. It landed squarely among the crew. In a split second, Sergeant Kennemore had covered it with his foot.

There was a violent, muffled explosion, but not a man was hurt. Not a man except Sergeant Kennemore. He had given both his legs to save his comrades' lives.

"When I was on active duty," says Sergeant Kennemore, "I sometimes wondered if people back home cared as much about stopping Reds as we did. Now that I'm a civilian, I know they do. And one proof is that so many of my neighbors are investing in E Bonds for our country's defense. Believe me, I know how important that defense is. So I'm investing, too, just as I hope you are!"

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ORIGINAL ARTICLES

Editor of the Month

GEORGE MORRIS PIERSOL, M.D.

Philadelphia

WORK AND HAPPINESS

THEODORE G. KLUMPP, M.D.
NEW YORK, N.Y.

A century and a half ago, Horace Walpole wrote these lines: "About the time I die, or a little later, the secret will be found of how to live forever." Feeling that enough time had passed to vouchsafe a reply, Helen Bevington answered:

Horace, be comforted to die.
One century has meandered by
And half the next since, it was
  true,
The temporal state eluded you.
Now as I read your pensive letter,
I wish myself that times were better
And I might boast how men
  contrive,
As you foretold, to stay alive.
By now we should possess the key
To fleshly immortality
And, if we wanted to, endeavour
  to live forever and forever.
This, to my infinite regret,
Is not a custom with us yet.
I write you, Horace, for good cheer
Life is about as usual here.

Unfortunately, life is about as usual here, so far as our knowledge of the nature of the aging process, and many of the chronic diseases are concerned.

Our research has hardly scratched the surface of such conditions as heart disease and coronary thrombosis, apoplexy, nephritis, arthritis, multiple sclerosis and cancer, which are only a few of the cheerful prospects of advancing years.

It is common knowledge that our population is increasing, and, at the same time, people are also living longer. But the death rate is not keeping pace with the birth rate, so that the proportion of older persons in our midst is rapidly increasing. Since the turn of the century, our population has doubled, but the number of persons over sixty-five has quadrupled. Today there are approximately twelve million persons sixty-five years of age and over. By 1980, in only twenty-seven years, it is anticipated that we will have approximately twice that number. If the total population increases as expected, in 1980 one of every seven persons living will be sixty-five years of age or over and two of every five will be forty-five years of age or over. In other words, in less than twenty-seven years we may expect to have a total of at least sixty-eight million persons who are forty-five and over and twenty-four million who are sixty-five and over. This means that we shall have more people over forty-five years of age than the total number employed at the present time.

Another factor of importance that is not so easily susceptible to statistical analysis, but is nevertheless clearly true, is that our older persons are healthier in body and mind than they used to be. Spectacular advances in medical and public health knowledge and their prompt application to the prevention and treatment of disease have been largely responsible for this. There is every reason to believe that these advances will continue, with the result that in the future, in living longer we will also be healthier.

What is the significance of these developments as far as the economics of employment is concerned? To be sure, we cannot consider this problem from the standpoint of employment alone, for it goes far beyond that. The age shift in our population promises to become one of the most important factors in influencing the entire economic and political structure of the nation. For one thing, if old folks are not content and their basic needs are not wisely met, they can act as a united group, the power of which has already been demonstrated in regional tests. A bloc of some twenty million voters, joined by a few million more of those approaching sixty-five can very easily make their own political and

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President, Winthrop-Stearns Company, New York, N.Y.

economic decisions, without much regard for the views of others. Under such circumstances, the wisdom that is supposed to come with age may not be so clearly manifest to the rest of us. When Winston Churchill so truly said, "You can measure the civilization of a people by the way they treat their older folks," he was not thinking of a day when we might begin to wonder how the old folks are going to treat the rest of us.

With this in mind, I see no way of escaping the conclusion that future developments must be considered from two distinct points of view; from the standpoint of the needs and wants of older people, the "human" side, and from the standpoint of the economics of the problem. The two must be reconciled or there will be trouble. Fortunately, many students of the problem believe the two points of view can be harmonized.

What do our elders want and need? Basically they want and need the same things as the rest of us—happiness and a fair measure of security. Obviously the formula for happiness contains many and varying ingredients, and there is no one prescription that will satisfy every need. But the experience of untold generations has shown that most human beings are not basically happy unless they have something useful to do, and this is particularly true of older individuals. It was Robert Burton who said, "Employment, which is nature's physician, is so essential to human happiness that indolence is justly considered as the mother of misery." After all we have little excuse for existence except to propagate our kind and to work. The first is essentially accomplished at an early age—after that there is nothing left but work. It's as basic as that. Youth, on the other hand, can loaf for a while content with opiate dreams of future achievements. But as we grow older, the realities of life are more clearly seen and less easily denied, and as we approach fifty and sixty, we can no longer derive solace from the pipe dreams of future achievements. Age plays for real stakes, not pastime. Older persons must have something to do, and it must be real. And the most real thing we have to sustain us in this life of ours is useful work.

Retirement is a successful experience for those who have been wise and foresighted enough to plan for it. But what they have planned for is most often merely a different kind of occupation. It is sometimes euphemistically called a hobby, which is nothing more than work with the sting of need taken out of it. You are an intellectual group with diversities of interest enabling you to adapt yourselves to a different way of life with relative ease. Most of you have more things that you want to do than time in which to do them. But you represent only a very thin, small, upper crust in our social structure. Unfortunately, most persons fail to cultivate a secondary occupational interest, and even if they could, they would rather continue with what they have been accustomed to doing. And there is reason to believe that it is biologically unsound to toss such individuals on the scrap heap before they are ready for it. For any living organism that has been accustomed to a set routine for forty or fifty years can't suddenly be shaken from its orbit without untoward consequences. Anyone who has studied Cannon's ideas on homeostasis will recognize this. It is a biologic fact that functions and living tissues which are not used decline and atrophy. Applied to longevity, it is also true that nature tends to eliminate those who have relinquished their functional usefulness. Atrophy of disuse, both physical and mental, is the most insidious and deadly poison known to man. The philosopher, Lord Bertrand Russell, now in his eightieth year, wrote, "Most of the men I have known who have retired from work have died of boredom shortly afterward. A man who has been active, even if he has thought throughout his life that a leisurely existence would be delightful, is apt to find life unbearable without some activity upon which to employ his faculties. I am convinced that survival is easier for those who can enjoy life,

and that a man who has sufficient vitality to reach old age cannot be happy unless he is active."

From a strictly scientific point of view, the aging process begins at conception. The very instant that cells, tissues, or organs stop growing they begin to decline. This decline marks the beginning of old age. It starts slowly, but it begins early in life. The thing popularly called old age is in truth only that period during which the rate of decline has progressed to the point where its manifestations are visible to the naked eye. But the important point is that the rate of decline is not the same for all human beings, nor is it equivalent for all organs and functions of the body. In the clinic, every physician sees individuals who are physically spent at forty-five and others who are in full possession of their faculties at sixty-five. Not infrequently, as far as wisdom and judgment are concerned, they are at their prime in the vicinity of sixty-five. What the responsible factors are we really don't know, despite the following intriguing suggestion:

The horse and mule live thirty
years,
And nothing know of wine or beers.
The goat and sheep at twenty die
And never taste of scotch or rye.
The cow drinks water by the ton,
And at eighteen is mostly done.
The dog at fifteen cashes in
Without the aid of rum or gin.
The cat in milk and water soaks
And after twelve short years it
croaks—
The modest, sober, bone-dry hen
Lays eggs for nogs, then dies at ten.
All animals are strictly dry;
They sinless live and early die.
But sinful, ginful, rum-soaked men
Survive for three score years and
ten.
And some of us, though mighty
few,
Stay pickled 'till we're ninety-two!!

Our society has been quite illogical and inconsistent in its attitude toward the older worker as far as compulsory retirement is concerned. On the one hand, it is apparent that we have no objection to electing and appointing older individuals to positions of the greatest responsibility in government, business, and the professions. Indeed, oftentimes their careers are just starting at a time of life when society is systematically dumping others on the scrap heap. For instance, in the 81st Congress more than 34 per cent of the senators were over sixty years of age. In the House of Representatives a total of almost 19 per cent was over sixty. A study was made of top business executives as listed in Poor's Directory. Here again, more than 44 per cent were over sixty years of age. I am certain that a study of leadership of the various professions would reveal the same large proportion of individuals in the older groups.

And yet, as far as the rank and file of workers is concerned, we have little objection to the imposition of blind and unselective compulsory retirement rules which automatically eliminate those in the ranks who have reached the same age, regardless of their fitness, ability, and contribution to the group for which they labor. More precious than oil or fertile soil, than ore and minerals, than trees or an equable climate, are the human resources of a country. All other things were here when Columbus came to America, but it took intelligent, industrious men to make our country what it is today.

We may not fully realize it, but it does not pay to waste the contributions of those, who through years of experience, have learned to do their jobs well and are willing and able to continue to do so faithfully. There is no substitute for training and experience, and when we retire a competent older worker, we are replacing a cog that meshes well with one that requires breaking in. But, if the premise is that individuals over sixty-five are not worth their keep, then least of all should we permit persons above those ages to occupy the top and critical positions in our social structure. If we acknowledge, as is certainly true, that some are and some are not fit and pulling their weight at those ages, then we should use our intelligence to devise

methods of determining for all workers, not just the upper crust, which are and which are not fit. Certainly a man isn't fit one day and unfit the next because one page of the calendar has been turned. As the great physiologist, Dr. A. J. Carlson, stated, "The physiologic age of the worker is not synonymous with his chronologic age, owing to the individual variables in heredity, mode of living, accidents, and sequelae of disease."

At the present time our life expectancy is sixty-seven years. When you and I were born (and that isn't so long ago), our life expectancy was a little over forty-three years. As medical science progresses, the life span may increase to limits hardly yet dreamed of. We might even look forward to the experience of an interesting person. His name was Christen Jacobsen Dragenberg. Dragenberg was a Dane who lived to be one hundred forty-six years of age, from 1626 to 1772. He went to sea when he was thirteen, took part in the wars of three kings against Sweden, served many nations in merchant navies, when nearly seventy was taken prisoner by Algerian pirates, was sold as a slave, escaped slavery after fifteen years, and at the age of eighty-four again went to war against Sweden. At one hundred eleven he married a woman of sixty, outlived her, proposed at one hundred thirty to several women but was rejected. Mastering his disappointment, he lived on for sixteen years. Described as being of impetuous temperament, he lived a life far from blameless, but in his last five years, from one hundred forty-one to one hundred forty-six, exhibited a conduct described as "quite respectable." If one man can live a life as full as this, there is no reason why science cannot make it possible eventually for many more of us to marry at one hundred eleven, propose and *Be Accepted* at one hundred thirty, and live to one hundred forty-six. In other words, I agree with George Bernard Shaw when he said, "It is a shame to waste such a wonderful thing as youth on youth."

We choose and select when we hire, and I see no reason why we can't do the same thing when we retire our workers. One of the best teachers it has been my privilege to know and an outstanding figure in public health work, Dr. Milton J. Rosenau, was retired from the Harvard University faculty on the basis of a compulsory retirement rule. He moved to another university where the rules were not so blind and where perhaps they could not afford the luxury of scrapping their best brains by the calendar. He continued his inspiring teaching, which I can assure you could be emulated by very few others, and was subsequently elected president of the American Public Health Association. The story is told that, as he lay on his deathbed, he cocked open one eye as he had a habit of doing, saw the pretty nurse standing before him, and spoke his last few words, "I feel I am taking a turn for the nurse."

From a sociologic standpoint, inflexible chronologic retirement rules are a reflection on the state of our intelligence in solving what ought to be a simple problem. Whenever society adopts a rule that eliminates the fit with the unfit, destroys the good with the bad, or punishes the innocent with the wicked, it is not a good rule. Civilization progresses by changing rules of this kind. In an imperfect society human beings are pushed around as a faceless mob. But social progress may be measured, in the last analysis, by the degree of skill and discrimination with which society solves the *Individual* problems of its members. I am afraid Winston Churchill had the right idea when he stated that we are still an immature civilization.

The argument has been advanced that we must clear out the older workers to make room for the younger men, so that their progress upward in an organization will not be unduly stymied. On the face of it, this line of reasoning appears to have some merit. But it is only another way of stating that there are more workers than there are jobs. During World War II, when there was a manpower shortage, no one was afraid that either the old or handicapped workers were taking jobs away from younger and more

able workers. At other times similar arguments have been applied against the employment of women in business, government, and the professions. Certainly there is no arbitrary age at which older workers begin to repress the advancement of younger individuals. In a sense, every older individual higher on the ladder of advancement, whether he be sixty-five or fifty-five, or forty-five, is holding a job that a younger individual aspires to and feels he can fill. That is always true, and it will be just as true if we force everyone to retire at fifty or even forty-five, as we will have to do by 1980, if we don't find a more logical way of reducing the disparity between jobs and workers.

We must not lose sight of the fact that someone must support those that we retire to idleness. The more workers we retire, and particularly if we should lower the retirement ages, the greater will be the economic burden we will place on those who work. The whole problem is the adjustment of the number of workers to the number of jobs available. To attempt to strike a balance by eliminating all workers over a certain age is an unfair penalty on age and experience. In a refined and delicate way, it is a perpetuation of the jungle law of the fang and claw, where the leaders of the pack survive only until the younger beasts grow fierce enough to eliminate them. In modern civilization we are less violent, but the end result is approximately the same. In pleading the cause of older workers, we are seeking to redress a wrong. It would serve no useful purpose in the long run if the only thing we accomplished were to shift the wrong, the burden of unemployment from the shoulders of age to youth. Let us not be frightened by the myopic oversimplification that narrow mindedly clamors, "Every job held by an older man is taking a job away from some young man who wants to get going, get married, start his family and advance in the world." Is our economic resourcefulness limited to such a simple antithesis? Have you ever heard of tapering off—less work, responsibility and shorter hours as workers grow older? Have you learned how some industries are preparing their workers for retirement, so that many more of them will welcome it and know what to do with it? Have you heard of more education for our young people so that they will be better equipped to earn a living? You once heard of a forty-eight hour week, and now we have a forty hour week. Is there any reason why we must stop at forty hours, if there isn't work enough to go around? These and others are steps that will lead us to the solution of this problem; and never make the mistake of selling America short on resourcefulness.

Another view that is widely held is that older individuals become over conservative, and that to make progress we must eliminate these obstacles in the path of progress. Here again there are such wide variations in human reaction patterns that I don't see how one can logically draw generalizations that will fit individual cases. A leopard does not change his spots as he grows older; they merely become more distinctive. Certainly Bernard Baruch, eighty-two years of age; Arturo Toscanini, age eighty-five; Herbert Hoover at seventy-eight; General MacArthur at seventy-two; Grandma Moses at ninety-two, and Ambassador Walter Gifford at sixty-seven are no obstacles in the path of progress. As far as the great mass of jobs now subject to compulsory retirement is concerned, it makes no difference at all whether an individual grows more or less conservative. If individuals in key positions become too conservative with age, or even too reckless, as they sometimes do, to meet the best interests of the organization, a retirement board operating on a selective basis can function to correct this development, as well as any other that may arise.

From an economic standpoint, is it a sound proposition to permit older workers to continue working so long as they are productive and desire to do so? As far as our national economy is concerned, there seems to be a number of good reasons why it is so. First, we must keep

in mind the fact that our national wealth, purchasing power, and standard of living rest squarely on productivity. Our economic stream seems to flow best when we have the largest number adding something to it and dipping out a commensurate amount. When large numbers of the population are unemployed they are neither contributing, nor, by the same token, are they in a position to consume as much. In other words, the economic turnover is at a low level.

If we did nothing about it and maintained present-day working standards and conditions, we might well be confronted with a potential labor surplus of over thirty million workers by 1980. Economic forecasting (not unlike election forecasting) is a hazardous undertaking, but he who approaches the task from the standpoint of a static economy in the United States is certainly going to be wrong.

With this in mind, we must allow, in our estimates, latitude for increased employment through the development of new industries. On the other hand, we are witnessing an unprecedented surge of interest in science, and its accomplishments are providing the pattern of a great socio-economic revolution. One of the major incentives of this scientific boom is the saving of time and labor, which in the end amounts to the same thing. We must anticipate the continued introduction of new labor-saving devices, perhaps on a scale never dreamed of before. The first fruits of this golden age of science are only beginning to ripen. In the future they will come to maturity at an accelerated pace with respect to life and labor-saving. The net effect of this may be against a substantial increase of man hours of available work in relation to man hours of available workers.

If we will employ one fifth of the twenty-four million over sixty-five years of age which we will have by 1980, at, let us say, an average of $2,500 per annum, it will mean twelve billion dollars per year that they will earn for themselves, and this load of support will be taken largely off the shoulders of younger workers, themselves included, whether by taxes or direct contributions.

Let us look at it from another point of view. We are witnessing today a great groundswell of public sentiment in favor of State or Federal old-age pensions for those over sixty-five. A figure of $100 a month has been prominently mentioned as an objective. By 1980, this could cost the country twenty-eight billion, eight-hundred million dollars. When this sum is added to other welfare benefits that have already been or have every promise of being adopted, we are confronted with an astronomic figure, which statesmen such as Bernard Baruch declare we cannot and will not be able to afford. As Mr. Baruch put it in this connection, "We dare not undertake more than our economy can stand or we will defeat our own purpose. We must get away from employment policies based on cold arithmetical averages and take advantage of the skills and judgment of older people. How hideous a mockery it would be if, as a result of advances in medicine, surgery, hygiene, and higher living standards, older people were left willing and able to work—but society deprived them of something useful to do." We are just beginning to wake up to the fact that the price is too high, not in terms of human decency, but in terms that even the businessman can understand.

The added years that science has given man place a new and greater responsibility on all of us as we grow older. We must make a greater effort to avoid the mental and physical atrophy of disuse, to which I have referred. Many of the unpleasant characteristics of old age are due to the fact that those involved have given up; they have stopped trying and stopped using their faculties to the fullest extent. Science has shown they have quit learning, not because they chose to. They have lost sight of what Oliver Wendell Holmes said, "To be seventy years young is sometimes far more cheerful and hopeful than to be forty years old."

The point of view that I have tried to give you about work and age applies with no less impact to those who are handicapped. The fulfillment of their destiny on earth is also incomplete un-

less they have something useful to do. In many respects, having longer to live, and having psychological as well as physical trauma to overcome, they need the balm of work, if anything, even more than their older colleagues.

And here is one of life's great paradoxes; the quest and goal of labor is to win security, comfort, rest, freedom from worry, freedom from hard work and freedom from the struggle. And yet the irony of it is that when a person finally and completely achieves such a goal, he is through—and he might as well be dead. The essence of life is its struggle. Viewed in this light, Mother Nature is a hard woman. But she is wise and tells us in Robert Louis Stevenson's words, "To travel hopefully is better than to arrive." And on our journey we must hold fast to the point of view of youth, expressed in the inscription in the library of the University of Pittsburgh, "Here is eternal spring, for you the very stars of heaven are new."

Thermal And Non-Thermal Changes In Isometric Tension, Contractile Protein, And Injury Potential, Produced In Frog Muscle By Ultrasonic Energy

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Studies of physicochemical systems during and after exposure to ultrasonic radiation have shown that both thermal and non-thermal effects are possible. Among the latter are included liquefaction of gels[1], emulsification[2-4], depolymerization[5-11], acceleration of chemical reactions[10,12-15], net movement of particles in one direction[16], and solvent streaming[17-18]. Except for the last two phenomena, cavitation has been a factor in the magnitude of the change noted[1,6,12].

As far as living systems are concerned, the evaluation of the relative importance of thermal and non-thermal effects of ultrasound has been more difficult. The statement has been made that the intensities and frequencies employed in physical medicine have no effect, as far as conduction in peripheral nerve is concerned, other than that produced by the rise in temperature[19]. It has been repeatedly suggested, however, that microorganisms could be affected independently of rises in temperature of the medium. Cavitation has been considered most important[20-24], though chemical changes in the medium may also be directly related[25].

In the study of isolated tissues, too, effects were noted which could not be explained entirely on the basis of a temperature elevation. Harvey[26] observed increases in irritability of frog heart muscle which could not be attributed exclusively to thermal effects. Many other workers[27,28] postulated effects, such as permeability changes[29-31], in which heating was not the primary factor. The evidence presented is not, however, completely convincing.

There have been two groups of studies, however, in which much more detailed and careful observations have

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been made. In the first, as a result of studies of dog and rat spinal cord and dog sciatic nerve, it was suggested, as far as the cord was concerned, that ultrasonic energy might have an effect on nerve in addition to its heating effect. For the sciatic nerve, however, the results were not clear cut, and one could not "conclude from the data collected . . . . . that there is an effect of ultrasonic energy on nerve tissue other than that of heat"[illegible].

The second group[illegible] also was concerned with effects of ultrasound on nervous tissue. It was concluded by these workers that ultrasound had an effect on neurones of the spinal cord, which was "primarily dependent upon physical factors other than temperature."

Few investigations have been directed towards muscle, a tissue with special importance for the physiatrist. Moreover, in view of the effect of ultrasound on macromolecules, the actomyosin molecule, because of its size, shape, and structure, might be peculiarly susceptible to alteration by ultrasonic radiation. It is because of these factors that study of ultrasonic effects on muscle was initiated. Of particular interest was the problem of which effects were thermal ones, and which, if any, were primarily non-thermal.

Methods

Isometric tension in the frog gastrocnemius was studied with an ink-writing technique, using procedures previously described[illegible]. The stimulus, an electrical one, was always several times supramaximal, and produced either an isometric twitch or tetanus. Temperature studies were made either with a copper-constantan thermocouple or a thermistor. In either case, accurate readings could not be taken during application of ultrasonic energy, and the first temperature readings were taken ten seconds after ultrasound application was completed. In many instances permanent records of temperature were made with the Brown potentiometer.

Ultrasonic energy was applied from a Birtcher ultrasonic therapy unit (Model U). The machine provides a continuous output at 1 megacycle, in doses up to 3 watts per sq. cm., with a treatment head area of 7 sq. cm. The ultrasonic energy was applied in some experiments to the intact frog muscle (skin removed), in others to extracted frog muscle. In the former technique, the treatment head was covered with a rubber condom filled with previously boiled water. The condom was then placed against the muscle, and contact between rubber and muscle was completed with a thin layer of mineral oil. The distance the energy had to traverse in water was approximately 2 cm. In the other technic, extracted muscle (technic described later in this paper) was placed in a watch glass, the treatment head immersed in the solution, and energy applied.

The effect of heat itself was analyzed by exposure of muscle (intact or extracted) to water at the desired temperature or to radiant energy (250 watt mazda bulb).

Studies of myosin and actomyosin content of the muscle were performed by the Viscosimetric technic at 0.C[illegible]. Muscle extraction was done by homogenizing at 0.C. for two minutes, using 3 ml. Weber's solution for each gm. of muscle. After the addition of 0.1 ml., 1% sodium salt of adenosine triphosphate per gram of muscle, homogenization was continued for two more minutes. The homogenization tube was washed with sufficient Weber's solution to make a final 1/8 dilution, and the homogenate was then refrigerated overnight. After such storage, the homogenate was diluted to 1/24 with 0.5 M KCl, filtered through coarse cheese cloth, and the filtrate centrifuged at approximately 3000 rpm for fifteen minutes, at a temperature below 5 C. The supernatant opalescent fluid was diluted 1:1 with 0.5 M KCl, and the specific viscosity

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The donation of the ultrasonic generator for research purposes by the Birtcher Corporation, Los Angeles, is gratefully acknowledged.

Intensity represents the mean output over the 7 sq. cm., and not the actual output at any one point.

of the liquid determined before and after the addition of the sodium salt of adenosine triphosphate. This enables one to determine myosin and undissociated actomyosin. When the muscle weight was less than approximately 0.4 gm., the initial diiutions were greater, so that the total volume of fluid homogenized would be at least 1.5 ml. Great care was exercised to keep the muscle extract and all added solutions close to 0.C. at all times. In addition, all solutions were prepared with distilled water passed through an ion exchange resin to remove all traces of copper.

Injury potentials were recorded with silver-silver chloride electrodes and a Leeds-Northrup d.c. amplifier. The gastrocnemius was kept under mineral oil, with one electrode on the intact membrane, the other on a crushed portion. After a control period of approximately twenty minutes, the muscle was either irradiated with a mazda bulb for one minute, or exposed to ultrasonic energy for the same period. For the latter, the ultrasonic head was placed at the top of the mineral oil layer. Temperature of the muscle-oil interface, in the region whose injury potential was being measured, was followed with a thermistor. As far as possible, studies of isometric tension, protein, and injury potential were carried out with one gastrocnemius serving as the control for the contralateral one.

Results

Low Intensity Ultrasound (0.5 - 0.75 watt per sq. cm.)

1) *Tension studies.* — Since effects were almost identical for the twitch and the tetanic response, only the isometric tetanus tension changes will be noted:

a) **Ultrasound.** — 0.5 watt per sq. cm (fig. 1, table 1). At this intensity a temperature rise of approximately 9-10 °C. produces a tension increase and no damage if applied for ten minutes or less, but irreversible damage if applied for more than this length of time. The final tension level reached depends upon the duration of irradiation.

b) **Ultrasound.** — 0.75 watt per sq. cm (fig. 2, table 1). The results obtained — the early increase and the later irreversible decrease in tension — are consistent with previous data on the effects of high temperatures. Although the intensity applied here is only slightly greater than in the previous series at 0.5 watt per sq. cm, the tension decrease is very much greater, paralleling the much greater rise of temperature.

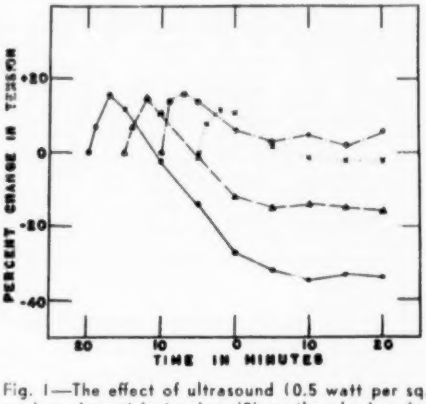

Fig. 1—The effect of ultrasound (0.5 watt per sq. cm.) on isometric tension. '0' on the abscissa indicates the end of the period of exposure, so that crosses represent 5 minutes, open circles 10 minutes, triangles 15 minutes, and closed circles 20 minutes of irradiation.

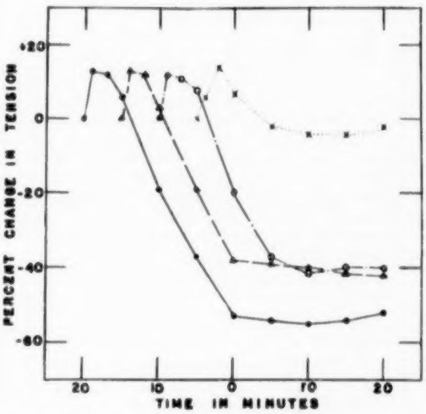

Fig. 2—The effect of ultrasound (0.75 watt per sq. cm.) on isometric tension. '0' on the abscissa indicates the end of the period of exposure, so that crosses represent 5 minutes, open circles 10 minutes, triangles 15 minutes, and closed circles 20 minutes of irradiation.

Table I. — Rises of Muscle[1] Temperature produced by Exposure to Ultrasonic Energy

Procedure	Duration of Exposure, Minutes	No. of Observations	Mean Temperature °C Control	Mean Temperature °C Maximum reached during irradiation
Ultrasound 0.5 watt per sq. cm.	5	8	23.4	33.2
	10	5	23.5	34.4
	15	8	23.8	34.3
	20	12	23.9	34.3
Ultrasound 0.75 watt per sq. cm.	5	8	23.5	36.4
	10	5	23.3	38.6
	15	10	23.3	37.3
	20	10	23.7	37.3

(1) Nerve and blood supply intact during these observations

c) **Effect of Nerve and Blood Supply.** — In order to determine the relationship of nerve and blood supply to the changes noted, ten experiments were performed, with exposure to ultrasound at 0.75 watt per sq. cm for twenty minutes, using twitch and tetanic responses to supramaximal stimuli. One gastrocnemius was irradiated with nerve and blood supply intact, in the manner described above, while the other was treated with both removed. From figure 3 it is noted that there is no difference in the response between in vitro and in vivo muscles, indicating that the change noted is a local one and not mediated through nerve or blood supply. All subsequent observations were made in the in vitro muscle, without nerve or blood supply.

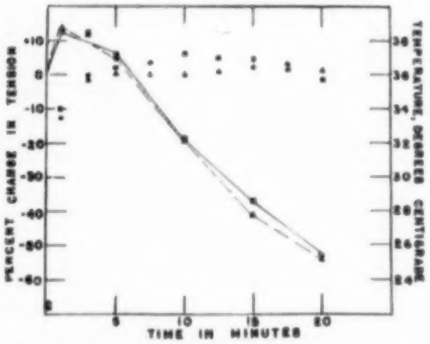

Fig. 3—Comparison of ultrasound (0.75 watt per sq. cm.) effect on isometric tension of the muscle with intact nerve and blood supply (open squares) and the muscle with nerve and blood supply removed (open triangles). The solid squares and triangles refer to the temperature changes in the in vivo and in vitro muscles, respectively. The abscissa refers to the duration of irradiation.

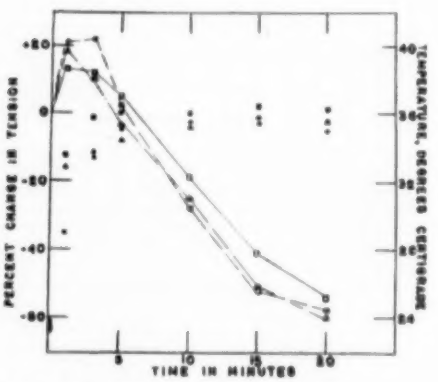

Fig. 4—Isometric tension (open) and temperature (solid) changes following exposure to ultrasonic energy (0.75 watt per sq. cm.) (squares), infrared radiation (circles), and water bath (triangles). The abscissa refers to the duration of exposure.

d) **Effect of Water Bath and Infrared Radiation.** — In twelve experiments the excised gastrocnemius was placed in an isotonic Ringer's bath and the temperature was raised to approximately the same levels as those reached with the ultrasound, though at a slower initial rate. The technic was such that the muscle was in air during the tension determinations, in order to duplicate the ultrasound procedure. The results (fig. 4) indicate that there is no difference in the tension changes produced by two technics (ultrasound and water bath). At fifteen minutes, the point at which the difference in tension was greatest, the p-value for the difference was 0.4-0.3.

The studies were repeated, using radiant energy for heating, with the muscle exposed to a 250 watt infrared lamp. The distance from lamp to muscle was varied in order to reach the desired temperature, but in eight experiments the range was 32 to 43 cm. Here, too, in comparing ultrasonic and radiant energy, no significant difference in tension change is noted (fig. 4).

2) *Studies of Myosin and Actomyosin.*—

a) **Ultrasound.** — 0.75 watt per sq. cm. for twenty minutes. As noted in table 2, a marked and significant decrease in total myosin and actomyosin is produced by low intensity ultrasound associated with high temperatures. Values for myosin alone and actomyosin alone are 62.6 mg/gm ± 3.7§ and 38.4 mg/gm ± 1.8, respectively, before ultrasound, and 36.1 mg/gm ± 3.2 and 28.9 mg/gm ± 1.8 after ultrasound. There was a 42 per cent decrease in myosin and a 25 per cent decrease in actomyosin.

b) **Infrared Radiation.** — Infrared radiation for twenty minutes, producing a rise of temperature similar to that produced by ultrasound, results in decreases in protein which are not significantly different from the changes which follow ultrasonic radiation (p-value for the difference 0.5). Control myosin and actomyosin values were 60.6 mg/gm ± 3.2 and 33.7 mg/gm ± 1.2, respectively, while after irradiation the values were 40.2 mg/gm ± 2.5 and 24.8 mg/gm ± 1.9. There was a 34 per cent decrease in myosin and a 26 per cent decrease in actomyosin. When rather high temperatures were produced by infrared and ultrasound, no significant difference between the two was noted, as far as tension change or protein decrease were concerned. This was further confirmed by the following three groups of observations (table 2, lines 3, 4, 5).

§ Standard error of the mean

c) **Continuous Ultrasound.** — With continuous ultrasound for ten minutes (line 3) the average maximal temperature reached was 37.3 C., and significant decreases in muscle protein were noted.

d) **Pulsed Ultrasound.** — When the ultrasound was pulsed (line 4) so that the total energy input was the same as above, but the temperature reached was no greater than 28.3 C., changes in protein were slight and not significant statistically. The isometric tension remained elevated during this entire period, at a level which was approximately 11 per cent above normal.

e) **Infrared Radiation.** — Infrared radiation for thirty minutes, producing temperature elevations of the same order of magnitude as in 'd' above (reaching 27.7 C.), had a similar effect on the muscle protein, producing slight decreases which were statistically insignificant. Here, too, the tension was increased approximately 11 per cent during the period of heating.

This entire section may be summarized by the statement that low intensity ultrasound, producing moderate to marked temperature elevations, is no different from heating produced by water bath or infrared radiation, as far as tension change and protein decrease are concerned. Greater intensities of ultrasound, for a shorter period of time, were studied next.

High Intensity Ultrasound (3.0 watts per sq. cm.)

1) *Isometric Tension and Contractile Protein in Intact Muscle.* — Differences between ultrasound (3.0 watts per sq. cm.) and infrared radiation were first noted when isometric tension was studied after a one minute exposure. With ultrasonics, the mean temperature rose

Table 2. — Effects of Ultrasonic and Infrared Radiation on the Myosin and Actomyosin Content of Striated Muscle[1]

	Procedure	Number of Experiments	Aver. Max. Temperature Reached °C	Myosin and Actomyosin, mg/gm[2] Control	After irradiation	Change %	S. E. %	p
1	U.S.[3] 0.75 w/sq. cm. 20 min.	15	36.2	101.0±5.1	65.0±4.0	—36	5.6	<.001
2	Infrared 20 min.	14	35.7	94.3±4.1	65.0±3.0	— 31	4.4	<.001
3	Continuous U.S. 0.75 w/sq. cm. 10 min.	11	37.3	94.4±5.1	75.1±5.4	—20	5.5	.01—.001
4	Pulsed U.S. 0.75 w/sq. cm., 1 sec. on, 2 sec. off, 30 min.	6	28.3	97.8±5.6	91.0±4.7	— 7	2.9	.1—.05
5	Infrared 30 min.	5	27.7	98.5±5.4	87.5±4.4	—11	5.5	.1
6	Pulsed U.S. 3.0 w/sq. cm., 1 sec. on, 2 sec. off, 1 min. Intact Muscle	6	29.4	107.7±4.3	107.7±3.8	0	1.6	>.9
7	Pulsed U.S. 3.0 w/sq. cm., 1 sec. on, 2 sec. off, 1 min. Extracted Muscle	13	19.3	93.6±3.4	65.6±3.4	—30	2.1	<.001
8	Infrared, 1 min. Extracted Muscle	11	32.4	98.6±4.2	91.0±3.8	— 8	2.4	.01
9	U.S. 0.5 w/sq. cm. 1 min. Extracted Muscle	10	20.2	103.4±5.0	94.0±4.1	— 9	1.3	<.001

(1) Nerve and blood supply removed during these observations
(2) Figures represent the mean ± 1 standard error
(3) U.S. — ultrasound

from 23.0 to 29.4 C., while with infrared the increase was from 23.4 to 29.0 C. Despite the similarity in temperature rise, the isometric tension changes were different. After infrared radiation the average tension increase was 21 per cent (± 5.5)§ while after ultrasonic radiation the increase was only 2 per cent (± 3.1). The difference was a significant one, with a p-value of 0.01. As noted in table 2, line 6, the contractile protein did not change as a result of such an exposure.

a) **High Intensity Ultrasound and Contractile Protein in Extracted Muscle.** — If the extracted muscle is exposed to ultrasound at 3.0 watts per sq. cm. for one minute (table 2, line 7), significant protein changes are produced. Two groups were prepared, one with a cooled ultrasonic head, the other with an uncooled head. The final mean temperature reached with the former was 16.3 C., with the latter 22.3 C., with a mean temperature rise of 6.1 C. Since the protein changes in the two groups were similar, the results were combined. The temperature elevation was the same as with the intact in vitro muscle (table 2, line 6), but the protein change was markedly different.

b) **Infrared and Contractile Protein in Extracted Muscle.** — Exposure of the extracted muscle to infrared radiation for one minute, with final mean temperatures of 32.4 C., produced slight decreases in muscle protein (table 2, line 8), even though the average temperature increase was greater than in 'b' above.

c) **Low Intensity Ultrasound and Contractile Protein in Extracted Muscle.** — Finally, low intensity ultrasound (0.5 watt per sq. cm.), producing temperature elevations similar to those noted with 3.0 watts per sq. cm, and reaching 20.2 C., resulted in protein decreases which were much smaller (table 2, line 9). Comparison of the decreases in contractile protein produced in the extracted muscle by infrared and low intensity ultrasound showed no significant difference. The high intensity ultrasound, however, produced a far greater decrease than either of the other two, (p <.001) even though the mean temperatures recorded were no greater.

2) *Low and High Intensity Ultrasound and Isometric Tension.* — Because of the relative uncertainty of temperature recording in an ultrasonic field, further comparisons were made between two different ultrasonic exposures, one of 3 watts per sq. cm. (14 experiments), the other of 0.75 watts per sq. cm. (32 experiments). The 3 watts per sq. cm. output was pulsed so that the temperatures reached at the two intensities would be similar. The isometric tension changes produced by the two intensities were significantly different after one and five minutes of irradiation (p <.001), but were almost identical with more prolonged periods of exposure (fig. 5). This suggested more strongly that when the intensity was high (3 watts per sq. cm.) ultrasound had an effect which was not a purely thermal one.

3) *Injury Potential.* — To analyze further this phenomenon, the injury potential was studied, comparing the

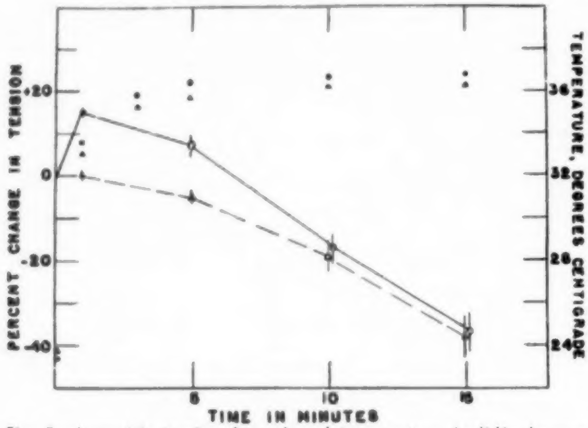

Fig. 5—Isometric tension (open) and temperature (solid) changes following exposure to ultrasound at 0.75 watt per sq. cm. (circles) and at 3.0 watts per sq. cm. (triangles). The vertical lines indicate one standard error from the mean tension change. The abscissa refers to the duration of exposure.

changes produced by radiant energy (25 experiments) with those produced by ultrasonic energy (30 experiments).

As noted in figure 6, the radiant energy produced small but consistent potential increases, whereas ultrasonic energy produced significant decreases. In 13 of the 30 observations with ultrasound, the pattern resembled the average pattern noted in the figure, with a marked initial potential fall, followed by a rebound towards control values, but never reaching them. In 11 observations there was a potential decrease without any recovery, in 2 no change in potential, and in 4 a slight increase. The reasons for the greater variability with ultrasonic than with infrared radiation will be discussed later. The temperature curves indicate greater initial cooling after ultrasonic energy was stopped than after radiant heating was terminated.

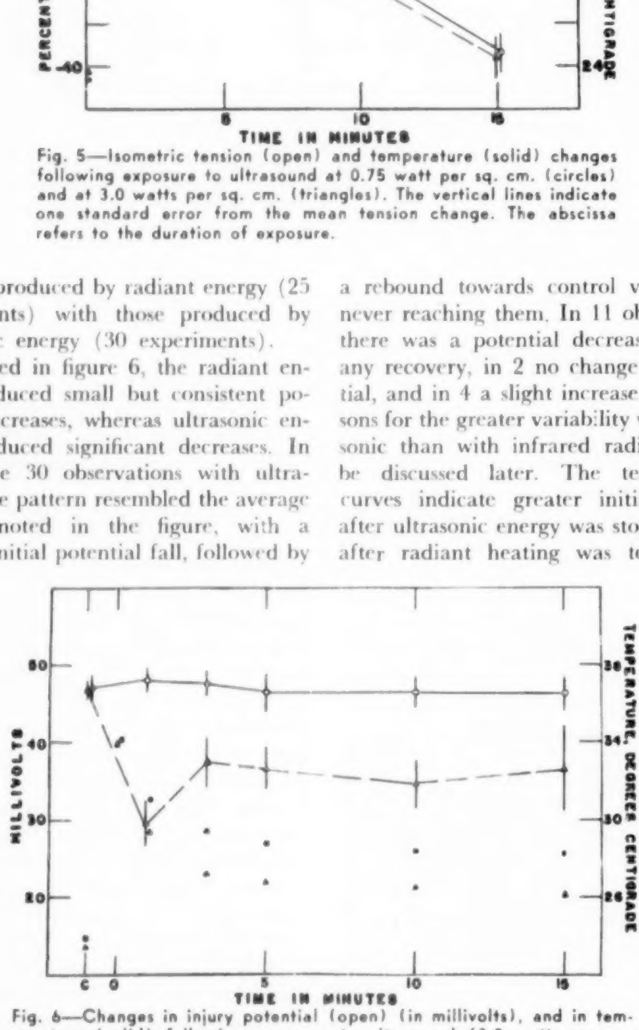

Fig. 6—Changes in injury potential (open) (in millivolts), and in temperature (solid) following exposure to ultrasound (3.0 watts per sq. cm.) (triangles) and to infrared radiation (circles). The vertical lines indicate one standard error from the mean potential. C indicates the last control reading, 0 the reading taken at the end of the one minute period of exposure, and the remaining values indicate the time after irradiation was stopped.

This is compatible with greater heating of the medium with radiant than with ultrasonic energy, but introduces the difficulty of determining the exact maximal temperature reached at the end of the ultrasonic application, and not ten seconds later, as was actually determined. If the temperatures reached after ultrasonic radiation are plotted logarithmically against time, and extrapolated back to zero time, a temperature of 34.5 - 35.0 C. is indicated at the end of the irradiation period. In 9 observations with infrared, mean temperatures of 38.4 C. were reached without noting the potential decline described for ultrasonics.

Comment

For the purposes of the present discussion, intensities of 0.5 - 0.75 watt per sq. cm. were classified as 'low intensity', and 3.0 watts per sq. cm. as 'high intensity'. As determined by studies of isometric tension and contractile protein, both in the intact and extracted muscle, there were no differences between low intensity ultrasonics and heating to the same temperature level by radiant energy or water bath. Moderate to marked temperature rises produced early tension increases, followed by irreversible tension decreases with more prolonged exposure. The changes noted were directly mediated, with no difference between the in vivo muscle and the muscle with nerve and blood supply severed.

Similar results were obtained on comparison of the myosin and actomyosin decreases produced by exposure to radiant and low intensity ultrasonic energy for twenty minutes. There was no significant difference between the two effects. This was further confirmed by pulsing the ultrasonic output so that the total energy output was unchanged; but the temperature rise was reduced. When this was done, decreases in muscle protein and in isometric tension were much smaller, and corresponded with changes produced by lower intensities of radiant energy. This low intensity radiant energy and the pulsed ultrasound produced comparable rises of temperature.

Differences between ultrasonic radiation and temperature rises of the same order of magnitude were, however, noted when a high intensity (3 watts per sq. cm.) of ultrasound was used. When radiant energy or low intensity ultrasound was used, muscle tension increased in the early phases of heating, whereas, with high intensity ultrasonic energy this initial increase was not noted. It was noted, however, that the contractile protein had not decreased significantly at a time when the tension change was already manifest. Extracted myosin and actomyosin, on the other hand, were significantly altered by high intensity ultrasonic radiation for short periods. The reasons for this difference in behavior between intact and extracted muscle have not been investigated further, but the following factors merit further consideration.

Significant amounts of ultrasonic energy may reach the muscle but, because of the much higher viscosity than in the extracted protein, fail to produce an effect. Such viscosity effects have been described. Stumpf and his co-workers[39] noted that bacterial disintegration decreased as the viscosity of the suspension increased. Presumably, sound pressures which are large enough to produce cavitation in thin suspensions may not do so in more viscous ones[40]. Furthermore, it has been suggested that cavitation, which may be responsible for death of unicellular organisms, occurs extracellulary[24,41]. Finally, cavitation ordinarily can be produced only in the presence of a free gas phase (gas nuclei)[42]. The difficulty of producing bubbles within muscle tissue[43,44] may therefore be a factor to be considered.

In the above considerations, the nature of the medium was given preponderant importance as a factor in preventing cavitation. Cavitation, in turn, has been found of major importance in producing changes which are not primarily thermal ones. Another factor to be considered, however, is the problem of the effect of an interface on an ultrasonic beam. This will be analyzed later.

One final possibility to be considered

in further study, is the existence of an internal effect, which may alter contractility, and which is either independent of a protein change, or is related to a protein change that is not detectable by the viscosimetric technique, which merely determines changes in molecular size and shape.

As noted above, protein changes in the intact muscle were not evident following ultrasound when the muscle temperature was kept low, even when tension changes were present. Significant membrane effects were, however, produced. Studies of injury potential showed a significant decrease following exposure to ultrasonic energy and a slight increase after exposure to radiant energy. The possibility that immersion of the metallic head in the oil medium may have altered the electric charge distribution at the membrane surface was considered. Although this could not be completely excluded, especially during the early period after removal of the ultrasonic head, the constant lower level of potential after the third minute made one feel that this was not an important factor in the final effect.

Greater effects at interfaces following ultrasonic exposure have been recorded previously. Lynn and Putnam[45] noted rupture of blood vessels only at the tissue interfaces. The question of unusual rises of temperature at interfaces must not be ignored. In a homogeneous medium the major rise in temperature results from viscous losses, the so called volume heating[46,47]. This effect decreases exponentially with the depth of penetration. A very small amount of heating results from the periodic pressure changes[16,18]. When the medium is not homogeneous, reflection and scattering results in unusual amounts of heating at interfaces[1,46,48]. The problem to be considered, therefore, is the possibility of excessive heating at the interface, which may be responsible for the membrane changes. This has been considered in detail by Fry, Wulff, and their coworkers[16,33-35], who were able to demonstrate ultrasound effects on nerve tissue when the average temperature of the medium was not excessive. Comparable situations existed in the present study. According to calculations by Fry, the difference between the average tissue temperature and the interface temperature at a sound intensity of 50 watts per sq. cm. is of the order of magnitude of 6.10^{-4} C. If this can be accepted for our present study, then a specific ultrasonic effect, still of undetermined nature, may be postulated for the muscle membrane. Another factor to be considered is cavitation in the oil in contact with the muscle. Cavitation in the surrounding medium was possible, with the attendant thermal and non-thermal results of cavitation.

It was noted above that the variability in the action of ultrasound on the membrane was quite great. In the static technique used here, the interference pattern may be related to such high variability. In addition, the emission pattern from the sound head is not a uniform one, so that an intensity of 3 watts per sq. cm. merely refers to the mean energy emission over the entire 7 sq. cm. of surface area, and does not indicate that each sq. cm. had the same intensity output. The intensity at the center of the beam was greater than that towards the periphery. For these two reasons, the exact spatial relation between sound head and muscle is of the greatest importance. This, unfortunately, was not controlled exactly in this study.

Summary

1. Isometric tension, injury potential, and myosin and actomyosin content of frog striated muscle were studied before and after exposure to ultrasonic radiation of low intensity (mean output of 0.5 to 0.75 watt/sq. cm.) and of high intensity (mean output of 3.0 watts per sq. cm.).

2. Low intensity ultrasound produced changes in isometric tension and in contractile protein which could be duplicated by raising the temperature of the muscle to the same levels with infrared radiant energy or water bath.

3. High intensity ultrasound produced

decreases in isometric tension and in injury potential of the intact muscle, and decreases in contractile protein of extracted muscle, which could not be duplicated by raising the mean temperature of the medium to the same levels by radiant energy.

4. The theoretical implications of the apparent "specific, non-thermal effect" of the high intensity ultrasound are discussed in terms of muscle viscosity and cavitation, and specific interface phenomena.

References

1. Freundlich, H. and Söllner, K.: The Influence of Ultrasonic Waves on Gels. Tr. Faraday Soc. 32:966, 1936.
2. Richards, William T.: Supersonic Phenomena. Rev. Modern Phys. 11:36, 1939.
3. Richards, William T.: The Chemical Effects of High Frequency Sound Waves. II. A Study of Emulsifying Action. J. Am. Chem. Soc. 51:1724, 1929.
4. Wood, R. W., and Loomis, Alfred L.: The Physical and Biological Effects of High-frequency Sound-waves of Great Intensity. Phil. Mag. 4:417, 1927.
5. Brohult, Sven: Splitting of Haemocyanin Molecule by Ultrasonic Waves. Nature 140:805, 1937.
6. Freundlich, H., and Gillings, D. W.: The Influence of Ultrasonic Waves on the Viscosity of Colloidal Solutions. Tr. Faraday Soc. 34:649, 1938.
7. Mark, H.: Some Applications of Ultrasonics in High-polymer Research. J. Acoustic Soc. America 16:183, 1945.
8. Oster, Gerald: Studies on the Sonic Treatment of Tobacco Mosaic Virus. J. Gen. Physiol. 31:89, 1947.
9. Stanley, W. M.: The Action of High Frequency Sound Waves on Tobacco Mosaic Virus. Science 80:339, 1934.
10. Szent-Györgyi, A.: Chemical and Biological Effects of Ultra-sonic Radiation. Nature 131:278, 1933.
11. Hintzelmann, Ulrich: Ultraschalltherapie rheumatischer Erkrankungen. Deutsche med. Wchnschr. 72:350, 1947.
12. Chambers, Leslie A., and Flosdorf, Earl W.: The Denaturation of Proteins by Sound Waves of Audible Frequencies. J. Biol. Chem. 114:75, 1936.
13. Liebermann, Leonard: Sound Propagation in Chemically Active Media. Phys. Rev. 76:1520, 1949.
14. Porter, C. W., and Young, Leona: A Molecular Rearrangement induced by Ultrasonic Waves. J. Am. Chem. Soc. 60:1497, 1938.
15. Schmitt, F. O.; Johnson, C. H., and Olson, A. R.: Oxidations promoted by Ultrasonic Radiation. J. Am. Chem. Soc. 51:370, 1929.
16. Fry, W. J.; Wulff, V. J.; Tucker, D., and Fry, F. J.: Physical Factors Involved in Ultrasonically Induced Changes in Living Systems. I. Identification of Non-temperature Effects. J. Acoustic Soc. America 22:867, 1950.
17. Eckart, Carl: Vortices and Streams caused by Sound Waves. Phys. Rev. 73:68, 1948.
18. Liebermann, L. N.: The Second Viscosity of Liquids. Phys. Rev. 75:1415, 1949.
19. Treanor, Walter J.: Unpublished data, referred to in: Present Status of Use of Ultrasonic Energy in Physical Medicine. J.A.M.A. 148:646, 1952.
20. Graber, P., et Rouyer, M.: La désintégration des microbes par les ultrasons. Ann. Inst. Pasteur 71:154, 1945.
21. Rouyer, M., et Graber, P.: Etude du mécanisme de l'action des ultrasons sur les microbes. Ann. Inst. Pasteur 73:215, 1947.
22. Schmitt, Francis O., and Uhlemeyer, Bertha: The Mechanism of the Lethal Effects of Ultrasonic Radiation. Proc. Soc. Exper. Biol. & Med. 27:626, 1930.
23. Harvey, E. Newton: Biological Aspects of Ultrasonic Waves: A General Survey. Biol. Bull. 59:306, 1930.
24. Harvey, E. Newton, and Loomis, Alfred L.: High Speed Photomicrography of Living Cells subjected to Supersonic Vibrations. J. Gen. Physiol. 15:147, 1931.
25. Loiseleur, J.: Sur le mode d'action des ultrasons sur les microbes. Ann. Inst. Pasteur 71:378, 1945.
26. Harvey, E. Newton: The Effect of High Frequency Sound Waves on Heart Muscle and other Irritable Tissues. Am. J. Physiol. 91:284, 1929.
27. Horvath, Joseph: Experimentelle Untersuchungen und therapeutische Erfahrungen mit Ultraschallwellen. Aerztl. Forsch. 3:11, 1949.
28. Pohlman, Reimar: Die Ultraschalltherapie. Quantitative Angaben zu ihrem Wirkungsmechanismus. Deutsche med. Wchnschr. 73:373, 1948.
29. Florstedt, H. u. Pohlman, R.: Ueber die percutane Applikation von Medikamenten durch Ultraschall. Ztschr. f. d. ges. exper. Med. 107:212, 1940.
30. Frenzel, H.; Hinskerg, K., u. Schultes, H.: Ueber den Einfluss des Ultraschalls auf Diffusionsvorgänge. Ztschr. f. d. ges. exper. Med. 96:811, 1935.
31. Pohlman, Reimar; Parow-Souchon, Eva, u. Schlungmaum, H.: Ueber die Temperaturverteilung im Lebenden Menschlichen Organismus bei Ultraschalleinstrahlung. Klin. Wchnschr. 26:277, 1948.

32. Anderson, Thomas P.; Wakim, Khalil G.; Herrick, J. F.; Bennett, Warren A., and Krusen, Frank H.: An Experimental Study of the Effects of Ultrasonic Energy on the Lower Part of the Spinal Cord and Peripheral Nerves. Arch. Phys. Med. 32:71, 1951.

33. Fry, W. J.; Tucker, D.; Fry, F. J., and Wulff, V. J.: Physical Factors involved in Ultrasonically induced Changes in Living Systems. II. Amplitude Duration Relations and the Effect of Hydrostatic Pressure for Nerve Tissue. J. Acoustic Soc. America 23:364, 1951.

34. Wulff, V. J.; Fry, W. J.; Tucker, Don, and Melton, Carlton: Effects of Ultrasonic Vibrations on Nerve Tissues. Proc. Soc. Exper. Biol. & Med. 76:361, 1951.

35. Wall, Patrick D.; Fry, William J.; Stephens, Ralph; Tucker, Don, and Lettvin, Jerome Y.: Changes Produced in the Central Nervous System by Ultrasound. Science 114:686, 1951.

36. Gersten, Jerome W.: Effect of Subthreshold Currents on Isometric Tension and Phosphocreatine Content of the Frog Gastrocnemius. Am. J. Psysiol. 168:458, 1952.

37. Csapo, A.: Actomyosin of the Uterus. Am. J. Physiol. 160:46, 1950.

38. Csapo, A., and Herrmann, Heinz: Quantitative Changes in Contractile Proteins of Chick Skeletal Muscle during and after Embryonic Development. Am. J. Physiol. 165:701, 1951.

39. Stumpf, P. K.; Green, D. E., and Smith, F. W., Jr.: Ultrasonic Disintegration as a Method of Extracting Bacterial Enzymes. J. Bact. 51:487, 1946.

40. Gregg, Earle C., Jr.: Ultrasonic Vibrations in Biophysical Research Methods, ed. Fred M. Uber, New York, Interscience Pub., Inc., 1950, p. 301.

41. Johnson, C. H.: The Lethal Effects of Ultrasonic Radiation. J. Physiol. 67:356, 1929.

42. Pease, Daniel C., and Blinks, L. R.: Cavitation from Solid Surfaces in the Absence of Gas Nuclei. J. Phys. & Colloid Chem. 51:556, 1947.

43. Gersh, Isidore; Hawkinson, Gladys E., and Rathbun, Edith N.: Tissue and Vascular Bubbles after Decompression from High Pressure Atmospheres—Correlation of Specific Gravity with Morphological Changes. J. Cell. & Comp. Physiol. 24:35, 1944.

44. Harvey, E. Newton; Whiteley, A. H.; McElroy, W. D.; Pease, D. C., and Barnes, D. K.: Bubble Formation in Animals. II. Gas Nuclei and their Destruction in Blood and Tissues. J. Cell. & Comp. Physiol. 24:23, 1944.

45. Lynn, John G., and Putnam, Tracy J.: Histology of Cerebral Lesions produced by Focused Ultrasound. Am. J. Path. 20:637, 1944.

46. Schwan, Herman P., and Carstensen, Edwin L.: Advantages and Limitations of Ultrasonics in Medicine. J.A.M.A. 149:121, 1952.

47. Piersol, George Morris; Schwan, Herman P.; Pennell, Robert B., and Carstensen, Edwin L.: Mechanism of Absorption of Ultrasonic Energy in Blood. Arch. Phys. Med. 33:327, 1952.

48. Richards, William T., and Loomis, Alfred L.: The Chemical Effects of High Frequency Sound Waves. J. Am. Chem. Soc. 49:3086, 1927.

Discussion

Dr. H. J. Bearzy (Dayton, Ohio): I want to congratulate Dr. Gersten on his presentation of this most interesting scientific preliminary study of the effect of ultrasonic radiations on muscles. Certainly with the lack of unanimity that exists regarding the exact method of action of ultrasonic energy, it must be left to such fundamental, basic biophysical studies to determine whether the physiologic effects of ultrasound are either thermal, mechanical, or chemical, or attributable to some other unknown factor.

I was pleased to see that Dr. Gersten chose to experiment with the low intensity ultrasonic outputs as well as with the higher intensities. Too many of our American research teams have experimented primarily with high and ultra high wattages and from their conclusions have put fear and doubt in the minds of clinicians who have been using or were desirous of using ultrasound energy as a therapeutic agent. Since the European clinicians have constantly used and advocated low intensity ultrasonic treatments and have reported their results in glowing terms, it is very important that much of our research should be done in this low intensity field, as well as in the higher intensities.

It was interesting to note that low intensity outputs of ultrasonic energy produced an increase in isometric tension at first but that with increased time exposure there occurred a drop in the tension. Such a reaction was produced

by infrared radiations or by a simple water bath. Higher intensities of ultrasonic energy produced a sudden decrease in isometric tension and in contractile protein which could not be duplicated by the heating agents mentioned. Such data unquestionably demonstrates that the effect of low intensity ultrasonic energy is primarily a thermal one, while higher intensity outputs must have an effect which is not primarily thermal. Can such experimental release of isometric tension be correlated with the clinical release of so called "muscle spasm" that has been reported in the literature after ultrasound therapy in numerous musculo-skeletal disorders? It must be left to additional research studies such as this one to determine whether factors other than thermal are produced by these higher wattage intensities. The in vivo and in vitro experiments point to a local or membrane effect of the ultrasound energy. It has been reported and demonstrated that some form of a membrane phenomenon on motor, sensory and sympathetic nerves may be the basis for the good results obtained in the treatment of many neuromuscular disorders.

I should like to ask Dr. Gersten what is the physiologic explanation of the protein changes in muscle after exposure to high intensity ultrasound energy? Also, could the thermal effects of the low intensities be eliminated by pulsating the ultrasound, and, in this manner, perhaps some of the other factors other than thermal be demonstrated in the low intensity range of ultrasonic energy.

Dr. J. W. Gersten (closing): The question has been asked whether cavitation may be of importance in producing the changes in protein noted in the homogenized muscle. As noted in the report, we feel that this is an important factor in the homogenized muscle, whereas in the intact muscle the high viscosity prevents cavitation and protein splitting.

Two types of controls were used, one a time control, the other a comparison with the contralateral muscle. For the first, the tension and the injury potential of the muscle were followed for periods up to one hour, and changes during this period compared with those which followed exposure to ultrasound or infrared radiation. For the second, the irradiated or exposed muscle was compared with the contralateral control muscle, and all changes were recorded as a per cent difference between the two. It was found that, although variation from animal to animal might be great, the differences between right and left gastrocnemius in the same animal were small.

IMPORTANT ANNOUNCEMENT

AMERICAN BOARD OF PHYSICAL MEDICINE AND REHABILITATION

The next examinations for the American Board of Physical Medicine and Rehabilitation will be held in Washington, D.C., September 5 and 6, 1954. The final date for filing applications in March 31, 1954. Applications for eligibility to the examinations should be mailed to the Secretary, Dr. Earl C. Elkins, 30 N. Michigan Ave., Chicago 2, Ill.

THE SURGICAL USES OF HIGH FREQUENCY CURRENT

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Cancer is one of the major causes of death in this country. Recent statistics will indicate that the number of cases has doubled in the past twenty years. This increase is due in part to better diagnostic skill and on the other hand, to the greater number of people who are reaching advanced age. The success of treatment is markedly influenced by the time that has elapsed between diagnosis and treatment. In the past, the patient has been to blame for delay in seeking diagnosis, but today with the increased publicity, the patient is coming to the physician much earlier. Today the delay is more likely to be due to the physician's procrastination. Not enough emphasis is placed upon the treatment of cancer in the medical schools and the young physician is inadequately prepared to treat these cases. In most schools he is taught that the treatment consists of radiation therapy, either x-ray or radium, or surgical removal. The young practitioner, not being equipped with these tools is likely to palliate and thus lose valuable time in attempting to treat the lesion with salves or other unsuccessful remedies.

It must be realized that cancer is generally best treated by the specialist, who should understand the indication for the use of x-ray, radium, surgery and the surgical effects of the high frequency currents. Unfortunately, the radiologist uses x-ray and radium, and the surgeon's only idea of treatment of cancer is the knife. The well qualified man should be familiar with all methods and be able to select that method which experience has shown will produce the best results in the case under consideration.

The surgical use of the high frequency currents has an important place in the treatment of cancer and the indications are quite clear in most cases. Many benign and pre-cancerous lesions, as well as accessible malignancies on the skin and in the mouth, are easier and better treated by the high frequency currents. A physician should have a working knowledge of the high frequency current before an attempt is made to use it in the more serious conditions. Technique can be easily learned. In the benign lesions and in any pre-cancerous lesions the average physician has in it a method which, if properly used, would prevent the development of cancer or, in its early stages, remove it effectively.

The use of high frequency current is limited to the treatment of accessible malignancies and benign or pre-cancerous lesions. Cancer of the skin is third in incidence in the male and seventh in the female and because of the ease of diagnosis, there is no excuse for delay in proper handling of these cases. It has been estimated that 6 per cent of cancer deaths are due to cancer of the skin; with our present knowledge, this is certainly well out of proportion to what it should be. It is imperative to bring these patients to the doctor in the very early stages and incumbent upon the physician to see that they are properly and adequately treated.

The high frequency currents make available to the physician three distinct effects. First is the so-called cutting current, which is usually produced by a short wave diathermy machine and finds its greatest use in general surgery. The cutting current is bipolar. A large electrode is placed on an indifferent part of the body. The active electrode may be a needle for straight cutting or a wire loop which can be used like a currette.

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This current produces a disintegration of the tissue without heat penetration to any depth. It will control bleeding from all small vessels and may be so used that healing will be by first intention. One of the most valuable uses of the cutting current is for taking biopsies, without bleeding or danger of spreading the disease from traumatism. It has been found to be of great value in brain surgery, particularly in the angiomatous type of growth. It is valuable as a hemostatic in many operations, particularly those in the brain and spine. The bleeding vessels should be caught with a hemostat and the active electrode touched to the hemostat, thus sealing the bleeding vessel. The urologist uses this current for transurethral resection. The gynecologist employs it for conization of the cervix. These uses are of more concern to the general surgeon and are not of particular interest to the average physician or physiatrist.

From the long wave diathermy machine is produced a current known as a desiccating current. This is a mono-polar current produced from a Tesla or Oudin coil. The current is conducted to a needle point electrode and it is possible to vary the degree of heat so that it will produce just enough to evaporate the moisture in the tissue, thus destroying the cell. The heat should not be sufficient to burn. This effect can be best demonstrated on a fresh piece of soap. The moisture in the soap can be evaporated, producing a dry soap powder. With the desiccating current a piece of paper can be interposed between the soap and the needle, so that the spark must pass through the paper before it strikes the soap. With the proper regulation of the current the soap will be desiccated without burning the paper, showing that the degree of heat is not sufficient to burn. Desiccated tissue when examined under the microscope, shows the cellular structure intact and the nucleus can still be identified, a picture which is not seen when greater degrees of heat are used.

The coagulating current is also produced by the long wave diathermy machine, and may be produced by some type of short wave currents by proper adjustment. A very strong mono-polar current may also produce a coagulating effect. As a rule, the coagulating, so-called D'Arsonval current is bi-polar; and the active electrode again is a needle point, although other types of applicators can be used. A large indifferent electrode is placed on some distant part of the body. The heat is produced in the tissue in such great volume that the tissue is actually coagulated in its own serum. Such tissue, when examined under the microscope, shows complete obliteration of the cells and nuclei and reveals nothing but a hyaline-like mass.

The technique of using the high frequency current to produce a surgical effect must be thoroughly understood and perfected if it is to be used successfully. Because of the almost universal availability of the high frequency currents, the physician has at his disposal a method of treatment that is very successful with benign and accessible malignant growths. The average physiatrist, with his knowledge of high frequency currents can, with experience, develop a good technique and certainly should be able to handle benign and pre-cancerous lesions, and eventually the smaller malignant lesion. Large and extensive growths should be left to those specializing in the treatment of cancer, who know the value of radiation, and surgery both by knife or destruction by the high frequency current and who are thus able to select the one or a combination of several agents best suited to the case under treatment.

The following advantages may be cited: 1.—The technique is simple and easy to learn but it should be realized that it must be mastered before one can hope to accomplish the best results. This method is certainly safe in the hands of the average physician in the treatment of benign and pre-cancerous lesions and, with sufficient experience, in small accessible malignancy. Certainly one member of every clinic should be proficient in the use of these surgical currents; 2.—anesthesia must be used, and in most

cases, injection of 1 per cent solution of novocaine is sufficient. The injection is made around the growth and not into the malignant tissue. It is never advisable to remove any growth without anesthesia, because it interferes with the successful completion of removal. In large growths, we can use a general anesthesia, such as thiopental sodium (sodium pentothal®). Ether can be used, but the ether and all gauze saturated with it must be removed from the patient before starting to operate, because the ether would ignite the minute the spark was turned on. However, there is not enough ether on the patient's breath to ignite and an operation can be started even within the patient's mouth as soon as the ether has been removed; 3.—asepsis should always be attempted, but it is not as important as in straight surgery because the current destroys the germs as well as the tissue. However, one always uses antiseptics, especially when local anesthesia is used; 4.—the current will destroy the normal as well as the abnormal tissue, so there is no selective action. However, in addition to the destructive effect, a considerable amount of heat penetrates deeply into the tissue well beyond the area actually destroyed. Cancer cells are abnormal and do not withstand the same degree of heat that the normal cells do, so that *malignant cells* some distance from the area actually destroyed, *are devitalized while the normal cells recover.* This means that recurrence is much less likely than is the case where the growth is surgically enucleated; 5.—a very good *cosmetic effect* is obtained, especially when the desiccating current is used, because a fibrous tissue reaction is not produced as a result of the low degree of heat. In treating malignancy, however, a good cosmetic result is the last consideration, but with benign lesions one can afford to go easier and attempt to get a good cosmetic result; 6.—*the current seals all blood vessels and lymph spaces,* so that the operation is practically bloodless and the chances of spreading the malignancy by manipulation during the operation are negligible, and 7.—the neoplasm is removed as a dead mass, the *entire growth being removed in a few moments* as compared to the weeks of treatment by radiation therapy. The entire growth must be completely removed at one treatment.

There is a definite indication for the use of the electrothermic method in *most malignancies of the skin and mucous membrane.* If one is experienced in the use of the surgical high frequency currents it presents the means of immediate and complete treatment as soon as the case is seen, thus preventing loss of time and unsuccessful use of palliative measures.

Radiation therapy is effective in the treatment of malignant growths showing an undifferentiated type of cell, but the more differentiated the cell, the less effective is radiation. It takes as much radiation therapy to destroy these cells as it does to destroy the normal tissue, so that the radiation dose must, therefore, be a destructive one. If a growth requires a destructive agent, it is better to use the electrothermic method, which destroys tissue thoroughly and with accurate control. There is no devitalizing effect produced on the surrounding tissue such as occurs with radiation, so that healing is quick and normal. At the same time, the disease is completely eradicated within a few moments. With radiation one can never repeat a canceride dose, as the skin is already devitalized and a radiation necrosis may result. With high frequency current, the surrounding tissue is normal and one can repeat the treatment as many times as necessary with equal chance of as good a result as the first time.

Malignancies of the skin offer the greatest field for the use of high frequency current. These lesions are usually slow in growth, seldom metastasize, and have a well differentiated type of cell which requires a destructive agent. If all the local disease is destroyed, practically every patient should get well.

The following technique is used with the desiccating current: The area is painted with an antiseptic. The lesion is then anesthetized by local injection of

A B

Fig. 1—A: Basal cell epithelioma of the neck; B: following removal with the current.

A B

Fig. 2—A: Squamous cell epithelioma engrafted on old angioma; B: results following destruction with high frequency current.

novocaine. The spark is regulated as required by the size of the growth. In small lesions, the desiccating current is ideal, but the large ones may require the coagulating current. The spark is applied to the healthy tissue adjacent to the growth, thus cutting it off from the healthy tissue and sealing the blood and lymph spaces. The needle should just brush the tissue, permitting a small spark gap. The entire growth is then systematically destroyed with the current. After circumvallating the growth, one divides it in half by making a line of destruction through the center, and then into quarters, systematically and thoroughly destroying each quarter. If the growth is large, the needle can be inserted into the tissue to get greater depth of destruction. A curette is then used to remove the de-

stroyed tissue and, with good technique, should leave a dry base. If the technique is not perfect and bleeding should occur, the bleeding vessel is sealed by an application of the current to the bleeding point. The final step is application to the base, with particular attention being paid to the edges and any suspicious areas. This desiccated base acts as a healthy sterile dressing and prevents pain, as the superficial nerve endings are destroyed and the live nerve endings underneath are protected by the desiccated base. In approximately one week's time nature throws off the destroyed tissue as a slough, leaving a healthy granulating base which will heal over in about three weeks, depending on the size. A good cosmetic result is also achieved. Small growths are simply and easily handled with the desiccating current with uniformly good results. Larger growths can be treated just as successfully, but more work is involved.

In using the coagulating current, a bipolar method must be employed. The indifferent electrode is a large metal plate 10 or 12 inches square, which can be placed on the back or another indifferent part of the body. The active electrode is a needle point. With the coagulating current the needle must be in contact with the tissue and can be plunged into the tissue for any desirable depth. The depth of the coagulation can be judged by the whitening which occurs around the sides of the needle. The needle is thus inserted throughout the growth penetrating just beyond the whitened area for each insertion until all the growth has been destroyed. The coagulated tissue is then removed either by the curette or with scissors. If any bleeding occurs, the current is re-applied until all diseased tissue is destroyed down to the healthy tissue. The important thing to remember in treating cancer is to overdo rather than underdo; the entire lesion should be destroyed at one sitting, otherwise the remaining cancer tissue is stimulated to more rapid growth. This current can be used in growths of large size and deeply infiltrating growths and will produce a wide and deep destruction of the tissue. Anesthesia is always necessary when the coagulating current is used.

The after-treatment is very important. The patient should be seen frequently and the wound cleansed with peroxide or other antiseptic solution. A dressing should be placed on the lesion, using any bland ointment. After a week or ten days the slough separates. This should be removed gently so as not to cause bleeding. A healthy red granulation surface then appears. It is usually possible when the slough separates to tell whether the lesion has been completely eradicated or not, as normal granulation has an entirely different appearance from that of malignant granulation.

All types of benign lesions such as warts, moles, papillomas, keratoses, leucoplakia, nevi, and chronic ulcers can be satisfactorily removed by desiccating current, usually with good cosmetic results.

Maligancy of the skin is usually basal cell in type and requires the use of a destructive agent. The high frequency currents are ideally suited for this type of lesion and if properly employed, will entirely eradicate the disease in most cases. The smaller lesions are easily treated by means of the desiccating current. The larger lesions require the use of the coagulating current. The results should be equally as good when the technique is correct.

Summary

1. The high frequency currents present an ideal method for the destruction of benign or malignant lesions which are accessible.

2. The technique is easy to learn and is available to any physician who has a high frequency machine and is willing to learn the procedures.

3. Early treatment of small lesions and removal of benign lesions that may become malignant will prevent the development of the large inoperable lesions occasionally seen.

4. Early recognition and early treatment is the way to improvement of our cancer statistics.

Discussion

Dr. William Bierman (New York, N.Y.): Dr. Schmidt's experience over a long period of years with the use of electrosurgery for the destruction of neoplasms leads him to emphasize the important role which the general practitioner plays in the early recognition and eradication of readily accessible lesions actually or potentially malignant. Because of this extremely important role which the general practitioner plays, Dr. Schmidt has furnished him with the details of the techniques required in the use of electrosurgery. The information contained in this paper is of value for the removal of benign as well as malignant lesions; but the greatest importance of Dr. Schmidt's paper, as I see it, is the contribution which it makes to cancer prevention.

PATTERNS OF VOLUNTARY MOVEMENT IN MAN

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Specific muscles are said to have limited roles in movement, and though many have been assigned multiple functions, these too have been clearly delimited. Too frequently the result has been that the muscles are considered merely as precise mechanical levers, without reference to the intricate and variable neuromuscular system which is also involved in movement. This approach has resulted in an incomplete understanding of normal voluntary movement as well as an inadequate restoration of normal function in individuals with paralysis.

With emphasis on the role of specific muscles in motion has come corresponding stress on the restoration of normal function in paralysis through the re-education of individual weak muscles. Once having ascertained which ones are involved, these are strengthened and every attempt is made to isolate them to avoid substitution of strong muscles for weak ones. By limiting motion to a single joint in a single direction, it has been thought that proper restoration of function can be brought about in such weakened muscles.

Actually, isolated muscle action is impossible even in the experimental animal where adjacent structures can be detached surgically. Each muscle in action automatically brings in an associated group of muscles, nerves and kinesthetic receptors. Isolated action does not result even from discrete electrical stimulation of the cortex. Murphy and Gellhorn[1] have reported that threshold stimulation of single motor points in the monkey cortex gives rise to mass movements rather than single muscle actions. Similar studies[2] have been reported for man. Mapping of the motor cortex has not altered Sherrington's contention that movements, not muscles, are represented in the cortex. Likewise, when cortical lesions occur in man as a result of disease, "damage to any part of the limb area results in weakness of movement in many muscles and at several joints."[3]

If isolated activity is impossible, how then must the therapy of paralysis be directed to restore function of muscles weakened by disease? Having observed that there is a striking similarity between the gross motions involved in all forms of activity, whether the end result be locomotion or object displacement, we

From the Kabat-Kaiser Institute, Vallejo, Calif.

have attempted to utilize these similarities in our rehabilitation program. Emphasis on mass movement patterns in physical therapy has yielded satisfactory results, since it has encouraged the return of function to groups of muscles rather than single muscles, permitting at the same time functional training applicable to a variety of activities. Subsidiary to this, it has been observed that neuromuscular facilitation occurs more readily in patterned mass movements than in attempted isolated motions[4].

It is not the purpose of this paper to detail such mass movement patterns as we have employed in therapy. These have been published[4] and will be described further elsewhere. The purpose of this communication is to present the background for our belief in the existence of movement patterns and to illustrate our thesis with data which will first show the interdependence of muscles and secondly illustrate the similarity of gross movements in various activities.

That such similarities are not generally understood is apparent from comments recently published by K. S. Lashley[5]: "Analysis of patterns of adaptive movement repeated in the same situation does not reveal a constant use of the same combination of muscles. . . . . The appropriate directions of movement can be imposed upon almost any motor system . . . the monkey with only partial recovery from paralyis after bilateral removal of the arm and leg motor areas may open a familiar problem box promptly and efficiently by a combination of movements never used preoperatively."

Lashley acknowledges the existence of "structural patterns in the nervous system," but he does not feel that these have any functional significance. Such a dichotomy of structure and function is contrary to our knowledge of biological phenomena; the two are always intimately related. The knowledge that motor behavior is not erratic but is the product of meticulous step-by-step development from the simple to the complex, accompanying simultaneous anatomical maturation in the nervous system, is a refutation of such dichotomy. Whereas it is true that behavior is plastic and movement may follow, many pathways as suggested by Lashley, given a specific motor goal, all normal individuals will respond in the same general manner to attain the desired end. Gait, for example, is remarkably uniform[14]. Differences are quantitative rather than qualitative.

We are aware that many studies have failed to derive any general motor patterns from numerous activities. One such is that of Slater-Hammel on the golf stroke[7]. His conclusion: "For most of the muscles under consideration, the variations were extensive enough to preclude the formulation of any single statement which could be consideed an accurate kinesiological analysis of the golf stroke," is certainly at variance with our knowledge of the consistency of the functional patterns of the golf stroke. Such functional patterns must in turn reflect consistent neuromuscular patterns. Inability to demonstrate these is due to faults in the experimental method. In the main, the chief fault seems to be excessive fragmentation of observations, so that the "forest is not seen for the trees."

Actually, locomotion, which is the highest physiological expression of all neuromuscular activity, shows an amazing coherence, not only in its final form, but in its development, both ontogenetically and phylogenetically. We can trace a continuous sequence from the first fetal movements as described by Coghill[8], Windle[9], and Hooker[10], through the neonatal patterns reported by Gesell[11] and McGraw[12], through the studies of pattern development by Pavlov[13], to final patterns of movement as aptly reported by Duchenne[6], the Webers[14], Steindler[15], Morton[16] and others.

There are three types of movement exhibited by muscles—myogenic, neurogenic, and reflexogenic[10]. The myogenic type originates within the muscle tissue itself without the intervention of a nervous impulse. It is an inherent property of the musculature. Neurogenic activity follows stimulation of the muscles by the motor neuron. Reflexogenic activity in-

volves the complete reflex arc including sensory, internuncial, and motor neurons; these three types follow each other in sequence in the developing fetus of lower animal forms. Coghill[8], for example, showed this for the fish, Opsanus; he states that "The neurogenic system chases the myogenic system off the end of the tail, the last of it appearing in the movements of the caudal fin, and at the same stage of development in the pectoral fin also." In man, the three types of fetal activity are not as clearly differentiated. There is little evidence for myogenic or neurogenic activity, although Minkowski[17] has demonstrated that stretching a fetal muscle may act as a stimulus for contraction even in the absence of a spinal cord. Reflexogenic activity is clear cut and appears about the middle of the seventh week[10]. According to the findings of Coghill and Hooker, the first reflex activity involves mass movements and only later do localized reflexes appear. Windle, on the other hand, believes the opposite to occur, at first the localized, then later the generalized reflexes appear. Regardless of which is correct, and Coghill would seem to be more so on the basis of the evidence, there is a continuous sequence of development from these first fetal movements to the mature adult motor patterns.

Hooker[10] states, "evidence so far gathered, appears to indicate that the behavior of vertebrate animals, including man, has its genesis in the early exteroceptive responses exhibited during embryonic, larval, or fetal life. . . . Each form of activity shown by any fetal organism is a step in normal development, hence, a step in preparation for postnatal behavior capabilities. Furthermore, there is a tendency for voluntary acts, where and when they appear, to develop in a sequence based upon the earlier reflexogenic sequence of prenatal life. This is particularly well demonstrated in the case of human behavior."

The transition from the reflex state to voluntary motion "is not fabricated by monumentally piling up simple reflexes."[18] There is, however, a direct relationship between the two as testified by the huge body of data accumulated by Pavlov on conditioned reflexes. Although the initial building stones for the final patterns of movement are fetal unconditioned reflexes, many of their original characteristics are altered in the transition to the conditioned forms. In animals, destruction of the cortex, for example, obliterates all conditioned responses and makes it almost impossible to form new ones. In the human, the destruction of even small portions of the cortex causes loss of motor function, with only a very primitive return to unconditioned reflexes (unlike the animal where simple reflex behavior is restored after cortical destruction).

The utilization of pre-existing reflexes in the development of movement patterns possibly can be understood in terms of Sherrington's phenomenon of convergence. The sensory impulse is mediated through the internuncial cells and in the case of the reflex, goes on to the muscles by way of the motoneuron pool. The motor cells of the anterior horn of the spinal cord and the áxons to which they give rise are referred to as "the final common pathway"[19] to which all motor impulses go, whether they originate as a result of stimulation of the sensory portion of the reflex arc or as a result of stimulation of the motor cortex.

As the first movements of the human fetus blend into the reflexes of the newborn, "By the end of fourteen weeks, practically all of the neonatal reflexes are present in the action system of the fetus. After fourteen weeks of gestation, fetal behavior development is primarily a matter of increasing strength of responses and increasing specificity rather than emergence of new types of reflexes."[11] Birth is only an incident in the gradual development of movement patterns. As the cortico-spinal tracts of the newborn mature functionally, the reflexes of the fetus are modified under the influence of the cortex. Any changes which occur, however, merely modify the basic groundwork for reflexes laid down earlier.

Experimental Work

We may demonstrate the interdependence of muscles, even of distantly located ones through the overflow of excitation which occurs during resistance to a particular movement*. By placing an electrode on the biceps, overflow may be demonstrated during flexion of the fingers. This is true whether the resistance is applied manually or is produced by placing an object in the patient's hand and having him force grasp-flexion contraction. The biceps remain quiet electrically during unimpeded finger flexion but become more active in proportion to the resistance applied (fig. 1). In the experiment, the wrist and elbow were kept immobile.

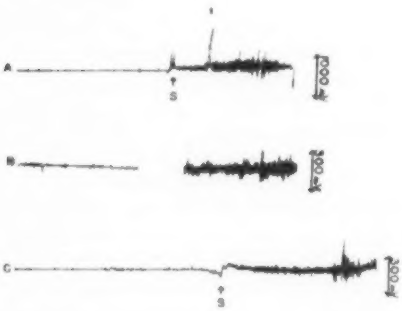

Fig. 1 This illustrates the overflow of excitation to adjacent and distant muscles as a result of proprioceptive facilitation following resistance to muscle contraction. The surface electrodes were placed on the biceps, triceps and posterior deltoid muscles. Resistance was offered to flexion of the fingers. The wrist and elbow were immobilized. Slight potential was apparent in all muscles studied following unimpeded flexion of the fingers. With resistance, potential was augmented. A. Potential observed in the biceps with the wrist held in the neutral position, elbow resting on a table flexed at an angle of 135 degrees. B. Potential observed in the triceps under the same conditions as A. C. Potential observed in the posterior deltoid with the wrist held in neutral position and the arm suspended by the side of the subject. S indicates the point at which resistance to flexion of the fingers was initiated by placing a solid object in the palm of the hand and having the subject force grasp flexion. Paper speed 0.5 cm./sec.

Conclusion: Overflow of excitation occurs in distant muscles as a result of resistance to muscle contraction. As a subsidiary observation, it is pointed out that with fatigue, there is an increase in potential observed in distant muscles.

*Experimental Method. Electromyography with an Offner six channel instrument was employed. An ink writer oscilloscope and sound apparatus was used for recording. Verification was obtained by palpation. Where skin electrodes were employed, results were verified through the use of bipolar needle electrodes. In no instance was there an attempt made to compare absolute potentials observed in different experiments; however, with the electrode in a single position, multiple observations were made with comparative quantitative accuracy.

Overflow of excitation as demonstrated in the foregoing, is quite obvious in weight lifters. Here every muscle of the body is involved in maximum effort. This has the practical purpose of stabilizing the whole musculature so that it may function more efficiently; irradiation of excitation brings in progressively more motor units and more muscles in a definite pattern of activity.

A number of factors determine the quantitative and qualitative relationships between the muscles involved in a movement. We have studied in detail some of those which are proprioceptive[19]. These include the positioning of the part, the degree of resistance, and the actual range of movement. Timing, synchronization, and coordination also play an important part in determining the relationships of the various muscles. In this regard, we have reported[20] studies on cocontraction and reciprocal innervation. And, of course, at the highest level of integration of motor function, variations in the voluntary impulses themselves, influenced by use, disuse, and learning, as well as the intensity of the volitional effort, are important determining factors in movement. All in all, motion is the expression of the most complicated aspects of nervous activity, and any attempt to fragment it into isolated muscle actions without regard to the many other factors involved will at best give a very distorted notion of its form and structure.

By observing normal activity in locomotion, work and sports, it has been possible to define a series of basic patterns of motion which are common to all of these activities. These are utilized in such diverse functions as walking, lifting, throwing, chopping, or swimming. It must be emphasized again that volition may modify the patterns of movement, but if the individual is thinking in terms of function and desires maximum performance with a minimum expenditure of energy, he automatically uses a pattern which in large part, is an habitual one incorporating the primitive components discussed. There is similarity in the various patterns of the upper extremities as well as those of the lower.

For the sake of simplicity, we have picked an example of this similarity, the comparison of the movements involved in kicking a football and those involved in walking; and to simplify these further, we refer only to the movements of one of the lower extremities.

It has been possible to study in detail some of the phases of various football movements in a group of experienced football players*. For the comparison with walking, we have selected the kick commonly referred to as the "punt," which is used in football when it is desired to displace the ball over the greatest distance with a maximum of accuracy. Accuracy is obtained by positioning of the ball and by synchronization of the movement. Preliminaries to the actual kicking procedures have been omitted, since these may vary depending on whether the "Rocker" or "Two-step" punt is preferred. The series of consecutive phases which constitute walking will be given first and then those for the punt type of kick.

Phases of Movement Involved in Walking (One Extremity)

Phase 1. Pivoting on the ball of the foot, the extremity thrusts off in extension prior to leaving the ground. In this phase, the hip, knee and ankle are extended and the toes are plantar-flexed. (In references to flexion and extension, the muscle groups involved are referred to rather than the positioning of the joint in the range of movement. For example, the knee is kept in a partially flexed position during the entire walking cycle and yet shows at different times both flexion and extension of the muscle groups moving this joint) (fig. 2).

Phase 2. The extremity goes into flexion and remains in flexion as it approaches the midline of the body. In this phase, the hip, knee and ankle are flexed and the toes are dorsiflexed. The pelvis undergoes slight transverse medial rotation; independently, the tibia and femur also are rotated. The upper trunk

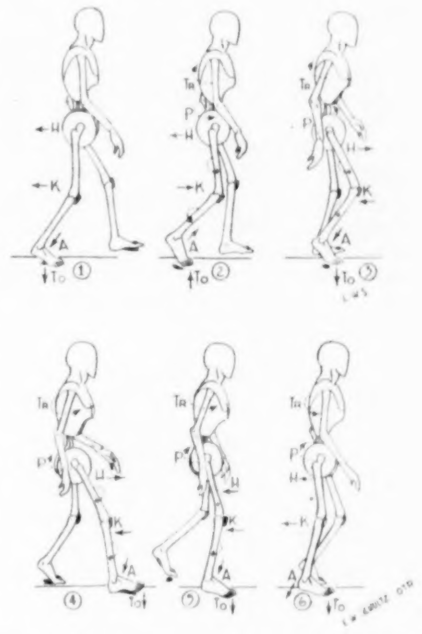

Fig. 2 This illustrates the phases of movement (illustrated in one extremity) involved in walking. H = hip, K = knee, A = ankle, To = toes, Tr = trunk, P = pelvis. Arrows indicate extension and flexion and **do not** indicate direction of movement. With the hip and knee, arrows pointing dorsally indicate extension, arrows pointing ventrally indicate flexion. With the ankle and toes, arrows pointing down indicate plantar-flexion, arrows pointing up indicate dorsiflexion. Broken line arrows indicate direction of rotation.

1. Extension of the right leg prior to lifting it off the ground. 2. The beginning of the flexion phase as the right leg moves forward. 3. The beginning of the extension phase as the right leg passes the midline of the body. 4. The continuation of the extension phase, the heel of the right foot touches the ground and the left leg begins its cycle corresponding to phase one in the right leg. 5. The extension phase of the right leg while the opposite leg goes through the beginning of its flexion phase corresponding to phase two in the right leg. 6. The continuation of the extension phase of the right leg as the opposite leg begins extension corresponding to phase three in the right leg.

undergoes reciprocal transverse rotation in relation to the pelvis, so that while the pelvis rotates medially, the ipsilateral portion of the upper trunk rotates in the opposite direction.

Phase 3. As the extremity reaches and passes the midline of the body, it goes into extension prior to touching the ground. In this phase, the hip continues to flex, but the ankle and knee are extended and the toes are plantar-flexed. Rotation continues as in phase two.

Phase 4. This phase is the extension phase at the time when the heel of the

*C. E. Thornhill, Head Football Coach of Stanford University, from 1933 to 1940, acted as consultant on football procedures.

foot touches the ground. The hip, knee and ankle are extended, and the toes are dorsiflexed. The rotation of the pelvis and trunk begins to reverse at this point.

Phase 5. The ball of the foot follows the heel in touching the ground, and while the opposite leg is swinging forward, the extremity in question is in complete extension prior to beginning phase one anew. In phase five, the hip, knee and ankle are extended, the toes are plantar-flexed and rotation is the same as in phase four.

Phases of Movement Involved in Kicking a "Punt" (One Extremity)

Phase 1. Just as in walking, the extremity pivots on the ball of the foot and thrusts off in extension prior to leaving the ground. The hip, knee and ankle are in extension and the toes are in plantar-flexion (fig. 3).

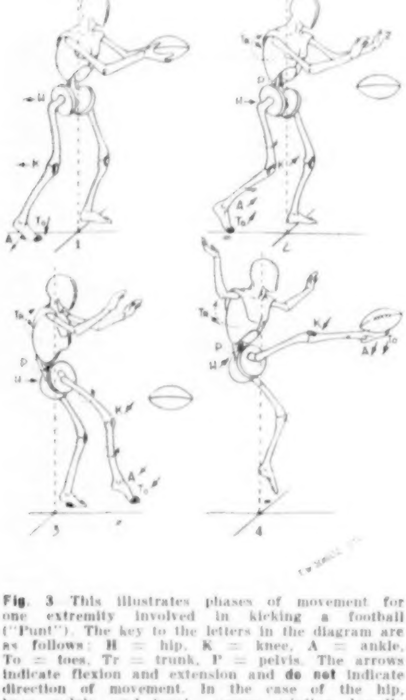

Fig. 3 This illustrates phases of movement for one extremity involved in kicking a football ("Punt"). The key to the letters in the diagram are as follows: H = hip, K = knee, A = ankle, To = toes, Tr = trunk, P = pelvis. The arrows indicate flexion and extension and **do not** indicate direction of movement. In the case of the hip, knee, pelvis, and trunk, arrows pointing dorsally indicate extension, arrows pointing ventrally indicate flexion, broken line arrows indicate rotation. In the ankle and toes, arrows pointing down indicate plantar-flexion, arrows pointing up indicate dorsiflexion.

1. The initial extension prior to lifting the right leg and carrying it forward. 2. The beginning of the flexion phase. 3. The extension phase which begins as the foot passes the midline of the body. 4. The extension phase in which the foot actually kicks the ball. Details of these movements are included in the text.

Phase 2. The extremity goes into flexion as it leaves the ground and is brought forward toward the midline of the body. The hip, knee and ankle are in flexion, and the toes are in dorsiflexion. There is medial rotation of the pelvis and independently of the tibia and femur.

Phase 3. As the extremity approaches the midline it goes into extension. The hip remains in flexion, but the ankle and knee are extended and the toes are plantar-flexed. There is internal rotation of the pelvis and of the femur and tibia as the foot approaches the ball. After kicking the ball, the trajectory of the leg is continued instead of ceasing as it does in walking. The same reciprocal relationship exists for rotation of the upper trunk as it does in walking in this phase and in phase two.

In all respects the phases of movement involved in the "Punt" are identical to those employed in walking; differences being merely quantitative, angles of flexion and degrees of rotation varying in this regard. In the last phase as the foot reaches the peak of the trajectory and is about to return to the ground, the angle of rotation is decreased.

We are continuing our studies in order to elaborate the details of rotation during the last phase of both walking and kicking. The determining factor in the point of alteration from flexion to extension in phases two and three is the need to keep the body in balance during the movement. This also influences the patterns of flexion, extension and rotation of the upper trunk. The proprioceptive influence of the otic labyrinth and associated mechanisms is evident in the rapid neuromuscular adjustments in changes in the distribution of forces around the center of gravity of the body.

Interestingly enough, the phases of movement described correspond grossly to those exhibited by the hind limb in natural locomotion in the dog and cat as reported by Philippson[21], and to the reflex stepping described by Sherrington[22] after spinal transection in the thoracic

region in the dog. In our experience, we have been able to observe a similarity in the flexion phase of stepping and in the flexion reflex of the lower extremity of the human paraplegic.

Summary

Interdependence of muscles, even of distantly located ones, through the overflow of excitation which occurs during resistance to a particular movement has been demonstrated.

The reflex patterns of movement of the fetus and newborn, which are common to most species, are found in man as components of mass movement patterns common to a variety of motor activities.

References

1. Murphy, J. P., and Gellhorn, E.: Multiplicity of Representation Versus Punctate Localization in the Motor Cortex. Arch. Neurol. & Psychiat. **54:**256, 1945.
2. Walshe, F. M. R.: Critical Studies in Neurology. Edinburgh, Scotland, E. and S. Livingstone, Ltd., 1948.
3. Denny-Brown, D., mentioned in Gellhorn, E.: Physiological Foundations of Neurology and Psychiatry. Minneapolis, University of Minnesota Press, 1953.
4. Kabat, H.: Studies on Neuromuscular Dysfunction: XV. The Role of Central Facilitation in Restoration of Motor Function in Paralysis. Arch. Phys. Med. **33:521** (Sept.) 1952.
5. Lashley, K. S.: Patterns of Organization in the Central Nervous System. Baltimore, Williams and Wilkins, 1952, chapter 25.
6. Duchenne, D. B.: Physiology of Motion (from the French edition of 1867). Philadelphia, J. B. Lippincott Co., 1949.
7. Slater-Hammel, A. T.: Action Current Study of Contraction Movement Relationships in Golf Stroke. Research Quart. **19:**164, 1948.
8. Coghill, G. E.: Anatomy and the Problem of Behavior. Cambridge, Mass., Cambridge University Press, 1929.
9. Windle, W. F.: Reflexes of Mammalian Embryos and Fetuses in Genetic Neurology, edited by Paul Weiss. Chicago, University of Chicago Press, 1950.
10. Hooker, D.: Prenatal Origin of Behavior. Lawrence, Kan., University of Kansas Press, 1952.
11. Gesell, A. L.: Studies in Child Development. New York, Harper and Bros., 1948.
12. McGraw, M. G.: Neuromuscular Maturation of the Human Infant. New York, Columbia University Press, 1943.
13. Pavlov, I. P.: Lectures on Conditioned Reflexes. New York, International Publishers, 1928.
14. Weber, E. F., and Weber, W. E.: Traite de la Mecanique des Organes de la Locomotion. Paris, Encyclopedic Anatomique, tome 2, 1843.
15. Steindler, A.: Mechanics of Normal and Pathological Locomotion in Man. Springfield, Ill., Charles C Thomas, 1935.
16. Morton, D. J.: Human Locomotion and Body Form. Baltimore, Williams and Wilkins, 1952.
17. Minkowski, M.: Neurobiologische Studien am Menschlichen Foetus. Handb. Biol. Arb. Meth. Abt. 5, Teil **5B:**511, 1928.
18. Herrick, C. J., and Coghill, George E.: Naturalist and Philosopher. Chicago, University of Chicago Press, 1949.
19. Levine, M. G., and Kabat, H.: Dynamics of Normal Voluntary Motion in Man. Permanente Found. M. Bull. **10:**212, 1952.
20. Levine, M. G., and Kabat, H.: Co-Contraction and Reciprocal Innervation in Voluntary Movement in Man. Science **116:**115, 1952.
21. Phillippson, M.: L'Antonomie et la Centralisation dans de Systeme Nerveux des Animaux, Etude de Physiologie Experimentale et Comparee. Bruxelles, Falk fils, 1905.
22. Sherrington, C. S.: Flexion-Reflex of the Limb, Crossed Extension Reflex, Reflex Stepping and Standing. J. Physiol. **40:**25, 1910.

BOOK REVIEWS

The reviews here published have been prepared by competent authorities and do not necessarily represent the opinions of the American Congress of Physical Medicine and Rehabilitation and/or the American Society of Physical Medicine and Rehabilitation.

DIAGNOSTIC TESTS IN NEUROLOGY. A Selection for Office Use. By *Robert Wartenberg*, M.D., Associate Clinical Professor of Neurology, University of California, School of Medicine, Los Angeles, California. Forewords by Sir *Gordon Holmes*, M.D., F.R.S., and by *Stanley Truman*, M.D. Cloth. Price, $4.50. Pp. 228, with illustrations. The Year Book Publishers, Inc., 200 E. Illinois Street, Chicago, 1953.

This text is meant for the use of the general practitioner (or for that matter the physiatrist) to clarify the clinical diagnosis of neurological disease by means of proper physical examination. The author's vast experience and knowledge of this particular subject of reflexes and other signs makes the text authoritative without the necessity of extensive bibliography. Besides descriptions of pathologic signs and how to elicit them, explanations are given as to why and when they can be counted on. Practicality is emphasized throughout, without any elaborate discussion of neuro-physiology. Physiatrists, who deal so frequently with neuromuscular disorders, should find this of particular value as will also the general practitioner. It is a book the specialist in neurology should peruse with interest and reward, as it may well help in improving his clinical diagnostic acumen and make unnecessary some laboratory procedures. It is not intended to take the place of a neurology text for the medical student, but is a helpful supplement and places a rightful stress on the importance of adequate clinical examination.

LOGAN TURNER'S DISEASES OF THE NOSE, THROAT, AND EAR. Edited by *Douglas Guthrie*. Assisted by *John P. Stewart*, with collaboration of *Charles E. Scott*, et al. Fifth edition. Cloth. Price, $8.00. Pp. 478, with 255 illustrations. Williams & Wilkins Company, Mount Royal and Guilford Aves., Baltimore 2, 1952.

This is the most practical, concise and informative book ever written in the field with which it is concerned. It is extremely well organized. For many years it has been used as a textbook for medical students in many of our leading medical schools. It meets the wide demands of the teacher and general practitioner. It will also interest the specialist. In this fifth edition, new material and new illustrations have been added, keeping pace with the revolutionized treatment of certain diseases and the other advances of modern times. The book is highly recommended for any physician treating diseases in this specialized field.

ADVANCES IN CANCER RESEARCH. Edited by *Jesse P. Greenstein*, National Cancer Institute, U. S. Public Health Service, Bethesda, Maryland and *Alexander Haddow*, Chester Beatty Research Institute, Royal Cancer Hospital, London, England. Volume I. Cloth. Price, $12.00. Pp. 590, with illustrations. Academic Press, Inc., 125 East 23rd St., New York 10, 1953.

This book is Volume I in a series designed to present the developments in the field of cancer research. Ten general subjects are presented by different authors. The subject matter is widely varied: Electronic configuration and carcinogenesis, epidermal carcinogenesis, milk agent, hormonal aspects, Rous no. 1 sarcoma, radioisotopes, carcinogenic aminozoa dyes, cytotoxic alkylating agents, nutrition, plasma proteins and enzymes. The presentations are concise, and clarity is assured by the definitions that are frequently given for purely technical terms. The text discusses results and interpretations rather than detailed methodology, though the basic techniques concerned are mentioned. There is a necessary limitation to the phases of cancer research that can be conveniently presented in a single volume, but the subjects here are well selected and cover a wide spectrum. Numerous references, old as well as the many recent, are found at the end of each section.

The style and the breadth of subject matter makes this book highly suitable for general reading; the detail of presentation and literature reviews merit its recommendation as a reference volume.

EDITORIALS

ARCHIVES OF PHYSICAL MEDICINE AND REHABILITATION
OFFICIAL JOURNAL

American Congress of Physical Medicine and Rehabilitation
American Society of Physical Medicine and Rehabilitation

A Message From The President

Wm. Benham Snow

The 1953 meeting of the Congress was a most satisfying medical gathering. The program was well organized and the scientific presentations interesting and forward looking. The committee reports at the business meeting evidenced that the Congress members are aware of their responsibilities and are actively carrying on their duties. The Board of Governors considered many matters of great importance to the association and for the advancement of Physical Medicine and Rehabilitation. One of the more important of these was the jurisdictional dispute which has arisen in the American Medical Association between Physical Medicine and Rehabilitation and our closely related specialty of Orthopedics. These specialties, supplementary to each other, have not as yet adjusted their positions to enmesh their work properly. The smooth manner in which these specialties function in many medical groups attests to the fact that they can and will get along together. Minor differences probably exist more in the minds of incompatible individuals than in the facts related to the better care of patients through cooperation of the two specialties. Much of the feeling which has been fomented is a matter of semantics. Some of the facts presented to us are distorted.

Such differences must be left to the judgment of elders in the profession accustomed to dealing with interrelationships in medicine and surgery. Physical Medicine and Rehabilitation has grown in stature to a specialty known for what it does. It accomplishes certain things for patients better than would treatment without the special knowledge and techniques it utilizes. Its scope is broad, but its work is well defined though not easy to express in words, due to its diversity. We are sure that by now the responsibilities of Physical Medicine and Rehabilitation to patients and to our medical associates are clearly silhouetted.

As President of the Congress, I wish to assure the membership that our stand in the matter has been taken. Everything will be done to present our case by our representatives best qualified to do so. As a specialty, we, of course, abide by the dictum which is passed down by the mature and seasoned thinking of members of the American Medical Association, who govern professional relationships. In the past, we have been guided by these worthy gentlemen. Physical Medicine and Rehabilitation has been doing work of such calibre and progress, as to be appreciated by both medicine and the public. Nothing can come out of this unhappy incident but better understanding and harmony.

To the membership of the Congress, I would suggest that you not be drawn into local heated discussions on this matter. Leave the negotiations to those whose duty it is. At the local level, dig in a little harder, "play ball," and remember rehabilitation depends for its success on teamwork. Rehabilitation represents the greatest example of joint cooperation of medical and lay-workers in the interest of disabled persons ever accumulated.

The outlook for the next year is bright. The support which I received from the members during the meeting, and since from those chosen to head committees for 1954, is such as to assure me that the year we are entering should be one of outstanding progress.

I have received your vote of confidence. Your mandate needs definition. This will depend on the information which reaches me from you, the membership. There is room on the agenda for any problems which you care to bring to me. I have only one foregone conclusion at this moment. Any action I take will be for the improvement of the specialty of Physical Medicine and Rehabilitation, and better treatment of patients falling under our care. To both of these purposes, my entire medical past has been, and my future will be dedicated.

From time to time throughout the year, I will be contacting the membership through this medium regarding matters which seem timely for discussion.

Wm Benham Snow

Committee on the Coordination and Integration of Physical Medicine and Rehabilitation in Geriatrics

The recently appointed Committee on the Coordination and Integration of Physical Medicine and Rehabilitation in Geriatrics has energetically begun its work by designing a questionnaire survey which will soon be in the hands of the Congress membership.

Physical medicine and rehabilitation has long been concerned with the problems of the chronically ill and this concern has already matured into valuable contributions for their care. The importance of this group as a medical and social problem is a byword today. Whether considered in terms of hospital beds, manpower, or just simple human dignity the chronically ill is one of the leading challenges of our time.

One part of this profound concern for the chronically ill which has rapidly been taking on enormous importance is the medical care of the aged. Closely related as it is to the chronically ill group, the aged can likewise be expected to produce a large share of locomotor and neuromuscular disabilities. That these disabilities can frequently be corrected or their effects removed or minimized is now an established fact.

This committee has been charged with

a vital task. While its chief point of orientation must be seen as better service to the patient, it is essential that criteria for the attainment of this end be established in terms of the various medical specialties as well as in terms of the patient's age. It is true that certain of the broad segments of man's life span have such consistent and identifiable problems that valid medical specialties come into being to cover these areas; it is likewise true that no medical specialty can function successfully to the exclusion of all others. Thus, for example, pediatrics and geriatrics are equally coexistent and interrelated with neurology, surgery, and psychiatry, and by the same logic with physical medicine and rehabilitation.

It is with this in mind that a committee to coordinate geriatrics with physical medicine and rehabilitation has been appointed. Its primary responsibility is to define the scope of physical medicine and rehabilitation in relation to geriatric problems. Of equal importance is the coordination of physical medicine and rehabilitation with its various kindred specialties of which geriatrics is only one.

Related professional organizations have already hailed our efforts in this field, and at our invitation liaison has been set up by them for the purposes of insuring close cooperation with this committee. Here is another opportunity for clinically well-trained physiatrists to offer concrete assistance and to develop their leadership in this new field of clinical medicine.

As a first step, the committee has undertaken to survey all the existing departments of physical medicine and rehabilitation as well as certain interested physicians. A questionnaire has been formulated and is being currently distributed. The scope of this survey includes the activities and the functional structure of the various departments of physical medicine and rehabilitation as well as their efforts, successful or unsuccessful, to arrive at definitive working relationships with other medical specialties and other hospital departments.

It is of equal importance to know what our experience has been in dealing with the problems of the aged both in a clinical and in an organizational sense. An overview of our collective experience should be invaluable in defining concepts, avoiding errors, and pointing to new avenues for development. At the same time the sharing of ideas and experience by the membership can only result in more unified and enriched relationships in meeting the common problems of our discipline.

The success of this survey is obviously dependent on the quality and quantity of participation. None of us can fail to profit by knowing what others are doing and thinking, comparing our own efforts, and possibly synthesizing new approaches as a result. We can anticipate with interest the committee's evaluation of all the replies to the questionnaire, as well as its own conclusions.

While the questionnaires will be distributed in the near future it is possible that through inadvertence there may be some who fail to receive one. If such be the case we urge that a copy be obtained from the Chairman of the Committee by writing to the Executive Secretary of the Congress.

We strongly urge the membership to look on the work of this committee as its own and when participating in the survey to feel free to include any ideas or suggestions which might be of value in our common effort.

Michael M. Dacso, M.D., Chairman
Committee on the Coordination and Integration of Physical Medicine and Rehabilitation in Geriatrics

MEDICAL NEWS

Members are invited to send to this office items of news of general interest, for example, those relating to society activities, new hospitals, education, etc. Programs should be received at least six weeks before the date of meeting.

POSTGRADUATE COURSES

The Office of the Surgeon General, Department of the Army, has announced that a series of short postgraduate courses will be conducted by the Army Medical Service during the fiscal year 1953-54.

The courses, which are listed according to the hospital or installation where they will be given are as follows: Brooke Army Medical Center, Clinical Laboratory Course (March 15-19, 1954); Letterman Army Hospital, Rehabilitation Techniques in Neuromuscular Diseases and Disabilities (April 5-10, 1954); Armed Forces Institute of Pathology, Pathology of the Oral Regions (March 8-12, 1954); Walter Reed Army Medical Center, Symposium on Physical and Mental Health Standards (April 16-17, 1954) and Recent Advances in Medicine and Surgery including Psychosomatic Aspects of Medicine and Surgery (April 19-20, 1954).

Applications for admission to any course must be submitted at least six weeks before the opening date. Army medical officers on active duty and full-time Civil Service physicians at Army installations should forward their applications through channels to the Office of the Surgeon General, Department of the Army, Washington 25, D.C., marked attention Personnel Division.

NEW AMA PAMPHLET

How the AMA may serve you . . . as one of its members . . . is the theme of a new pamphlet which the American Medical Association has published. Designed to acquaint members with the AMA's many activities and services, "It's Your AMA" will be mailed to every member, and, thereafter, will be sent to each new member of the Association.

DR. BEARZY HONORED

Dr. Herman J. Bearzy, director of physical medicine and rehabilitation at Miami Valley Hospital, Dayton, Ohio, became the second physician in Ohio to receive a citation from President Eisenhower's Employ-the-Physically-Handicapped Committee.

The citation to Dr. Bearzy was "in recognition of outstanding efforts expended in forwarding equal opportunities in employment for the physically handicapped."

RECENT PUBLICATIONS BY MEMBERS

Rene Cailliet, with co-authors, "Adenosine-5-Monophosphate in Treatment of Multiple Sclerosis." American Journal of Medical Sciences, July, 1953.

Samuel G. Feuer, "Rehabilitation Goals in Pediatrics." The Physical Therapy Review, October, 1953.

Louis W. Granirer, "Isolation of an Antigouty Factor from Postpartum Plasma: Preliminary Report." New York State Journal of Medicine, July 1, 1953.

Herman Kabat, with co-authors, "The Application of Neuromuscular Facilitation in the Treatment of Shoulder Disabilities." The Physical Therapy Review, October, 1953.

George M. Piersol, "Therapeutic Application of Ultrasonic Therapy." Postgraduate Medicine, July, 1953.

Louis Rudin, with co-authors, "Corrective Brace for the Upper Extremity in Hemiplegia." The Journal of The American Medical Association, October 3, 1953.

Jessie Wright, "Realism in the Art of Rehabilitation (editorial)." The Pennsylvania Medical Journal, October, 1953.

LATIN-AMERICAN CONGRESS OF PHYSICAL MEDICINE

Through the courtesy of the Government of Colombia, expressly, the University of Antioqua and the Dean of the Medical School, the Latin-American Congress of Physical Medicine is invited to hold its annual meeting in the city of Medellin. The cities of Bogota, Barranquilla and Montega Bay, Jamaica will be visited after the meeting.

Activities of the group will be divided into sections representing the various fields in

Medicine, Surgery and Pharmacy. It will offer physicians of the United States an opportunity to cement their friendship with their colleagues in the Latin-American countries.

Transportation at a special all-inclusive rate via plane or steamship is available. The meeting is scheduled for February 15-28, 1954. Registration must be made through Dr. Cassius Lopez de Victoria, Executive Director, 176 E. 71st Street, New York 21, N. Y.

SOCIETY RECEIVES AWARD

For outstanding achievement and service through its nationwide program of employment for the crippled, the National Society for Crippled Children and Adults has been awarded the Distinguished Service Certificate by The President's Committee on Employment of the Physically Handicapped.

The Easter Seal Society was cited for pioneering many new programs and projects for the handicapped, and for the public attention its activities have focused on the national program to employ the physically handicapped. This service has been carried out by the National Society through its vast network of more than 2,000 state and local Easter Seal affiliates located in every state in the nation, District of Columbia, Alaska, Hawaii and Puerto Rico.

Dr. William T. Sanger of Richmond, Va., is president of the National Society. Headquarters of the Easter Seal Society are at 11 S. LaSalle Street, Chicago, with Lawrence J. Linck, executive director.

The National Society each year grants fellowship awards to qualified counselors, guidance teachers and other professional persons for specialized training in the placement of the cerebral palsied and other severely handicapped workers. This training is designed to encourage public and private agencies to increase their services for the handicapped and to inform industry of the vast national resource available in the employment of the disabled.

FISKE FUND CONTEST

A prize of $250 is offered by the trustees of the Fiske Fund of the Rhode Island Medical Society for the best dissertation on "Recent Advances in Cardiac Surgery." The entry will be particularly graded on the basis of original work by the author and his observation of patients. It must be typewritten and double-spaced on standard typewriter paper and should not exceed 10,000 words. Entries, inscribed with motto and accompanied by a sealed envelope bearing the same motto and containing the contestant's name and address should be sent on or before December 2 to John E. Farrell, Sc.D., 106 Francis St., Providence 3, R. I.

COMING MEETINGS

American College of Chest Physicians: Twentieth annual meeting, San Francisco, June 17-20, 1954. Physicians interested in presenting scientific papers on any phase in the diagnosis and treatment of heart and lung disease should send a 100 word abstract, no later than January 1, 1954, to Dr. Edgar Mayer, Chairman of the Committee on Scientific Program, 850 Fifth Ave., New York 21, N. Y.

Conference on Scientific Editorial Problems: Second conference, Boston, Mass., December 27, 1953. Marian Fineman, Editorial Branch, Dugway Proving Ground, Tooele, Utah, is Chairman.

Pan American Medical Association: Ninth cruise-congress to South America and the West Indies, January 6-22, 1954. Dr. Joseph J. Eller, 745 Fifth Ave., New York, N. Y., is Executive Director.

PRIZE ESSAY CONTEST

The American Dermatological Association is again offering a series of prizes for the best essays submitted for original work, not previously published, relative to some fundamental aspect of dermatology or syphilology. The purpose of this contest is to stimulate investigators to original work in these fields. Cash prizes will be awarded as follows: Five hundred dollars, three hundred dollars and two hundred dollars for first, second and third place, respectively.

Manuscripts typed in English with double spacing and ample margins as for publication, together with illustrations, charts, and tables, all of which must be in triplicate, are to be submitted no later than December 1, 1953. The manuscripts should be sent to Dr. J. Lamar Callaway, Secretary, American Dermatological Association, Duke Hospital, Durham, North Carolina.

FELLOWSHIPS AVAILABLE

The National Foundation for Infantile Paralysis announces the availability of a limited number of additional postdoctoral fellowships to candidates whose interests are research and teaching in medicine and the related biological and physical sciences. The purpose of these National Foundation fellowships is to increase the number of professional workers qualified to give leadership in the solution of basic and clinical research problems including those of poliomyelitis and other crippling diseases.

The fellowships cover a period of from one to five years. Stipends to Fellows range from $3,600-$7,000 a year, with marital and dependency status considered in determining individual awards. Institutions which accept Fellows receive additional compensation for

expenses incurred in relation to their training programs.

Eligibility requirements include United States citizenship (or the declared intention of becoming a citizen), sound health and an M.D., Ph.D., or an equivalent degree.

Selection of candidates is made by a Fellowship Committee composed of leaders in the fields of medical research and professional education. The designation "Fellow of The National Foundation for Infantile Paralysis" will be given to successful candidates.

A total of 181 fellowship awards in these categories has been made by the National Foundation up to August 1, 1953.

Complete information concerning qualifications and applications may be obtained from: Division of Professional Education, The National Foundation for Infantile Paralysis, 120 Broadway, New York 5, New York.

INVITATION

The Jewish Sanitarium and Hospital for Chronic Diseases, East 49th St. at Rutland Rd., Brooklyn, N. Y., cordially invites all doctors and therapists who are interested in observing the activities of the Rehabilitation Center to visit the organization. This is one of the largest institutions dealing with chronic diseases.

MUSCULAR DYSTROPHY PUBLICATION AVAILABLE

Review copies of the "Proceedings of the First and Second Medical Conferences of the Muscular Dystrophy Associations of America, Inc.," held in New York City on April 14-15, 1951 and May 17-18, 1952, are available on request. Edited by Ade T. Milhorat, M.D., of New York Hospital and Chairman of the M.D.A.A. Medical Advisory Board, the book contains excerpts of papers read at the conference and abstracts of talks made during a symposium at the second session. Copies may be had by writing M.D.A.A., 39 Broadway, New York 6, N. Y.

ANNOUNCEMENT OF REGULAR CORPS EXAMINATION FOR MEDICAL OFFICERS

A competitive examination for appointment of Medical Officers to the Regular Corps of the United States Public Health Service will be held on February 2, 3, and 4, 1954. Examinations will be held at a number of points throughout the United States, located as centrally as possible in relation to the homes of candidates.

The Regular Corps is a commissioned officer corps composed of members of various medical and scientific professions, appointed in appropriate categories such as medicine, dentistry, nursing, engineering, pharmacy, etc.

Application forms and additional information may be obtained by writing to the Chief, Division of Commissioned Officers, Public Health Service, Department of Health, Education, and Welfare, Washington 25, D. C. Completed application forms must be received in the Division of Commissioned Officers no later than December 24, 1953. Applications received after that date may not be accepted and will be returned to the applicant.

DR. TURNER APPOINTED SECRETARY

Dr. Edward L. Turner, dean of the School of Medicine and chairman of the Division of Health Sciences of the University of Washington in Seattle since 1945, has been appointed Secretary and administrative officer of the Council on Medical Education and Hospitals of the American Medical Association. Dr. Turner assumed the secretaryship on October 1, 1953.

BOOKS RECEIVED

Books received are acknowledged in this column as full return for the courtesy of the senders. Reviews will be published in future issues of the journal. Books listed are not available for lending.

THE TROUBLED MIND by Beulah C. Bosselman, The Ronald Press Co., New York, N. Y.

REPORT ON ACTIVITIES OF W. K. KELLOGG FOUNDATION, W. K. Foundation, Battle Creek, Mich.

REHABILITATION OF THE OLDER WORKER edited by Wilma Donahue, James Rae, Jr., and Roger B. Berry, University of Michigan Press, Ann Arbor, Mich.

LIVING WITH A DISABILITY by Howard A. Rusk and Eugene J. Taylor, The Blakiston Co., Inc., Garden City, N. Y.

INTRODUCTION TO PHYSIOLOGICAL AND PATHOLOGICAL CHEMISTRY, INTRODUCTION AND LABORATORY CHEMISTRY by L. Earle Arnow, The C. V. Mosby Co., St. Louis, Mo.

IT'S NOT ALL IN YOUR MIND by H. J. Berglund and H. L. Nichols, Jr., North Castle Books, Greenwich, Conn.

THE GREEN AND RED PLANET by Hubertus Strughold, The University of New Mexico Press, Albuquerque, N. M.

HEADACHES: THEIR NATURE AND TREATMENT by Stewart Wolf and Harold G. Wolff, Little, Brown and Co., Boston, Mass.

THE MUSCULOSKELETAL SYSTEM by New York Academy of Medicine, The MacMillan Co., New York, N. Y.

POLIOMYELITIS by W. Ritchie Russell, The Williams & Wilkins Co., Baltimore, Md.

THERAPEUTICS IN INTERNAL MEDICINE (SECOND EDITION) by Franklin A. Kyser, Paul B. Hoeber, Inc., New York, N. Y.

FUNCTIONAL AND SURGICAL ANATOMY OF THE HAND by Emanuel H. Kaplan, J. B. Lippincott Co., Philadelphia, Pa.

WHEN YOU MARRY by Evelyn Millis Duvall, Association Press, New York, N. Y.

DYSARTHRIC SPEECH by Emil Froeschels, Expression Co., Magnolia, Mass.

THE MANAGEMENT OF PAIN by John J. Bonica, Lea & Febiger, Philadelphia, Pa.

MANUAL OF UPPER EXTREMITY PROSTHETICS by R. D. Aylesworth, National Research Council, Washington, D. C.

TABER'S CYCLOPEDIC MEDICAL DICTIONARY by C. W. Taber, F. A. Davis Co., Philadelphia, Pa.

ADVANCES IN BIOLOGICAL AND MEDICAL PHYSICS by J. H. Lawrence and C. A. Tobias, Academic Press, New York, N. Y.

PHYSICAL MEDICINE AND REHABILITATION by Basil Kiernander, Charles C Thomas, Springfield, Ill.

RESPIRATORY DISEASES AND ALLERGY by Josef S. Smul, Medical Library Co., New York, N. Y.

MANAGING YOUR CORONARY by William A. Brams, J. B. Lippincott Co., Philadelphia, Pa.

APPLIED ANATOMY AND KINESIOLOGY (SEVENTH EDITION) by Wilbur Pardon Bowen (revised by Henry A. Stone), Lea & Febiger, Philadelphia, Pa.

DISABILITY EVALUATION: PRINCIPLES OF TREATMENT OF COMPENSABLE INJURIES (FIFTH EDITION) by Earl D. McBride, J. B. Lippincott Co., Philadelphia, Pa.

APPARATUS ACCEPTED

The following information relative to newly accepted apparatus is reprinted, with permission, from the June 27, 1953; August 8, 1953; August 29, 1953; September 5, 1953, and October 17, 1953 issues of The Journal of The American Medical Association.

Ohio Oxygen Tent, Model 90A: Ohio Chemical & Surgical Equipment Co. (A Division of Air Reduction Co., Inc.), 1400 E. Washington Ave., Madison 10, Wis.

The Ohio Oxygen Tent, Model 90A, is a device for administering oxygen to patients in bed. It consists of a canopy of transparent plastic and a cabinet, mounted on casters, for cooling and circulating the oxygen. The cooling and circulating mechanism requires 50 to 60-cycle alternating current at 115 volts and it draws 630 watts. The crated tent measures 140 by 64 by 64 cm. (55 by 25 by 25 in.), and weighs 89 kg. (265 lb.). This shipping weight includes the regulator and tent hood.

From a source acceptable to the Council evidence was obtained indicating that oxygen concentrations exceeding 50% could be obtained under this tent with an oxygen flow of 8 liters per minute.

Multitone Muscle Stimulator, Model 3: Bilton Laboratories, Inc., 100 S. Broad St., Philadelphia 10.

The Multitone Muscle Stimulator, Model 3, is an apparatus for generating electric currents to stimulate innervated voluntary muscles as an aid in rehabilitation, to retard muscle atrophy, and to prevent adhesions and joint atrophy in patients who cannot exercise voluntarily. The apparatus weighs 11.3 kg. (25 lb.) and is portable. It requires a source of 60-cycle alternating current at 110 volts and draws 22 watts.

It is equipped with eight circular electrodes so that more than one muscle can be exercised at a time. A selector switch set at "Push-Pull" energizes the right and left circuits alternately and thus makes it possible to elicit reciprocating contractions of antagonistic muscle pairs. Other controls permit adjustment of intensities and frequencies. The apparatus is accepted for use under medical supervision in stimulating normally innervated muscles.

Ille Mobile Sitz Bath, Model SB 100: Ille Electric Corporation, 50 Mill Road, Freeport, Long Island, N. Y.

The Ille Mobile Sitz Bath is a metal chair with the seat modified for application of heated water to the perineal region. It is intended for use in treatment or postoperative care in gynecologic, obstetric, and rectal cases. A heater maintains the temperature of the water during the interval between filling of the bath and immersion of the part to be treated. The heating unit operates on either direct or alternating current at 115 volts and draws 325 watts.

The chair frame is made of aluminum tubing; the water pan is of stainless steel. The unpacked article weighs 13.6 kg. (30 lb.) and measures 89 by 74 by 61 cm. (35 by 29 by 24 in.). Packed for shipment it measures 102 by 76 by 76 cm. (40 by 30 by 30 in.) and weighs 38.6 kg. (85 lb.). The apparatus has the approval of Underwriters' Laboratories, Inc.

Schroeter Whirlpool Carriage, Model B: C. M. Sorenson Co., Inc., 50-19 47th Ave., Woodside, Long Island, N. Y.

The Schroeter Whirlpool Carriage is a device for agitating the water in a bathtub or basin. It can be moved alongside the tub, the top of the apparatus then raised, rotated through an angle of 90 degrees, and lowered over the side of the tub into the water.

This apparatus is a successor to the Schroeter Whirlpool Carriage, Model A, accepted by the Council in 1948, when it was

manufactured by Whirlpool Carriage, Inc., of Brooklyn. Model B is lighter, weighing only 27 kg. (50 lb.) and is high enough to swing over the edge of a tub 45 cm. (18 in.) above the floor. The motor requires either alternating or direct current at 110 volts and draws 400 watts.

Emerson Rocking Bed, Standard Hospital Model: J. H. Emerson Company, 22 Cottage Park Ave., Cambridge 40, Mass.

The Emerson Rocking Bed is an apparatus designed to aid the respiration of patients with poliomyelitis during the transition from dependence on the tank type of respirator to independence. The rocking bed may provide necessary breathing aid for patients with partial but not extreme paralysis of the breathing muscles. The rocking bed is not intended to be substituted for the tank type respirator.

The apparatus measures 120 (high) by 200 by 92 cm. (4 by 6½ by 3 ft.) and weighs 227 kg. (500 lb.). Crated for shipment it measures 244 by 137 by 122 cm. (8 by 4½ by 4 ft.) and weighs 250 kg. (550 lb.). It operates on a standard light circuit and draws 782 watts. The motor requires 115 volt alternating current at 60 cycles, unless otherwise specified.

When the bed is in operation, it oscillates about a fulcrum that is 16 to 18 cm. (7 to 8 in.) below the level of the patient's body, producing a to-and-fro motion. At the same time the longitudinal axis of the patient's body tilts +30 to -30 degrees about the horizontal and makes a total oscillation of 60 degrees. The speed is adjustable to conform with the patient's normal breathing rate, that is, from 15 to 26 oscillations per minute.

Rodenstock Eye Refractometer: Optische Werke G. Rodenstock, Munich 5, Germany. Distributor: Anton Heilman, 75 Madison Ave., New York 16.

The Rodenstock Eye Refractrometer is an instrument for measuring the total refractive power of the eye and determining its astigmatism, including the inclination of axis. Crated for shipment, the instrument measures 49 by 78 by 66 cm. (19 by 21 by 26 in.) and weighs 50 kg. (110 lb.). This shipping weight includes the following accessories: a schematic eye for practice, a transformer for 110 to 220 volt alternating current or a converter for direct current supply, spare bulbs, sanitary shield, shield for the eye not being examined, plastic cover, carrying case, and a wrench for releasing the instrument from the carrying case.

Evidence from sources acceptable to the Council showed that the instrument was sound in principle as a means of measuring ametropias and astigmatism.

Infantair, Model 1500: Continental Hospital Service, Inc., 18636 Detroit Ave., Cleveland (Lakewood) 7, Ohio.

The Infantair, Model 1500, is an incubator for infants equipped to supply warmth, humidity, and oxygen. The top, called the Perma-Vue Hood, is a rectangular dome molded out of a single piece of stout transparent plastic substance with two portholes. A nipple is provided for attachment to the supply of oxygen.

The apparatus requires 110 volts of either alternating or direct current and draws 736 watts. It is equipped with casters for rolling on the floor. Unpacked, it measures 123 (height) by 89 by 50 cm. (48½ by 35 by 19½ in.) and weighs 48 kg. (105 lb.). Packed for shipment it weighs 119 kg. (260 lb.) and measures 132 by 94 by 56 cm. (52 by 37 by 22 in.).

Evidence from sources acceptable to the Council indicated that this apparatus is sound in construction and satisfactory in operation.

NEWLY REGISTERED THERAPISTS

October 6, 1953

Allis, John Bert, 391 Hope St., Providence 6, R.I.

Askins, Abraham, 111 E. 21 St., Brooklyn 26, N.Y.

Behrman, Seymour William, 1643 45 St., Brooklyn 4, N.Y.

Benger, Leland Frederick, 68 Hoyt St., New Canaan, Conn.

Berlinghoff, Eleaner Ruth, 65 W. Roosevelt Ave., Roosevelt, N.Y.

Bogardus, Carolyn Jean, 370 Bedford Rd., Pleasantville, N.Y.

Bossenbrock, Carmen Louise, Box 725, Dryden, Wash.

Brdlik, Joseph, 12 Welwyn Rd., Apt. 3D., Great Neck, N.Y.

Bullivant, Diane Elizabeth, 01545 S. W. Military Rd., Portland 1, Ore.

Burtch, Robert Leverette, 24 Willow Pl., Brooklyn 2, N.Y.

Carey, James Michael, 263 James St., Bridgeport 4, Conn.

Curry, Norvelle, 1084 S. Orleans St., Memphis, Tenn.

Dahlquist, Don, 269 N. State, Preston, Idaho.

Dorando, August Charles, 189-04 64th Ave., Apt. 1A, Flushing 65, N.Y.

Engel, Elizabeth Barbara, N. County Rd., Miller Place, L.I., N.Y.

Feitelberg, Samuel Bernard, 1875 University Ave., Bronx 53, N.Y.

Gerrity, Clare Joann, 817 90th St., North Bergen, N.J.

Gettys, Betty Barron, 1817 Ebenezer Rd., Rock Hill, S.C.

Gibson, Marjorie Ellen, 530 E. 23rd St., New York, N.Y.

Gruen, Lester, 862 Amsterdam Ave., New York 25, N.Y.
Hanf, Liselotte Caroline, Great Quarter Rd., Sandy Hook, Conn.
Hill, Barbara L., 720 E. Beckwith Ave., Missoula, Mont.
Hoe, Richard Appel, 79 Clay St., Le Roy, N.Y.
Hoog, Josef, 1745 Eastburn Ave., Apt. E-5, Bronx 57, N.Y.
Huxford, Henrietta, 173 E. Genesee St., Skaneateles, N.Y.
Jessum, Richard Arthur, 140-75 Burden Crescent, Jamaica, New York, N.Y.
Keys, Theodore M., 2715 Georgia Ave., N. W., Washington, D. C.
Killeen, James, 5078 46th St., Woodside 77, N.Y.
Kostenbader, Betty Lou, Rt. 2, Sunnyside Wash.
Landweer, Marjorie Ann, 2474 Crestmont Pl., Seattle 99, Wash.
Lash, Richard Monty, 35 Thompson Ave., Babylon, L.I., N.Y.
Leonard, Kathryn Jane, 1087 Melrose Terr., Dubuque, Iowa.
Limbach, Paula Bettirose, 515 E. 11th Ave., Denver, Colo.
Lodato, Antoinette, 247 W. Broad St., Stamford, Conn.
Maitinsky, Steven, 331 W. 27 St., New York, N.Y.
Mansfield, Kathryn Cecelia, 8 Chestnut St., Yonkers, N.Y.
May, Bella J., 2311 Yale Ave. N., Apt. A., Seattle, Wash.
McKendrick, Bryan Floyd, 23 Glenwood Ave., Tooele, Utah.
Mitchell, Dorothy Theodora, 940 Olympic St., Memphis 7, Tenn.
Oliva, Michael John, 39 Ryerson Ave., Paterson, N.J.
Patterson, Clarence Nicholas, 819 7th St., N. W., Roanoke 17, Va.
Phillips, Suzanne Parsons, 218 W. Main St., Palmyra, N.Y.
Pogue, Beverly Seymour, 100 Waverly St., Yonkers 2, N.Y.
Rabiner, Loretta Carol, 120 E. 19th St., Brooklyn, N.Y.
Rhoden, Vincent George, 114 Vroom St., Jersey City, N.J.
Rizzo, Thomas Peter, 223 E. 117, New York 35, N.Y.
Robertson, Katharine Jaeger, 1402 Main St., Grinnell, Iowa.
Roddewig, Judith Ann, 1207 Richmond Lane, Wilmette, Ill.
Rosenfelder, Ruth Frances, 721 Bonhill Rd., Los Angeles 49, Calif.
Ryan, Mary Louise, 741 Addison, Palo Alto, Calif.
Ryder, Thomas Francis, Jr., 112 Clove Ave., Haverstraw, N.Y.
Satterlee, Ronald A., 237 Thompson St., New York 12, N.Y.
Sidel, Lawrence, 1534 Webster Ave., Bronx 57, New York, N.Y.
Sims, Robert, 968 St. Nicholas Ave., c/o B. Freeman, Apt. 50, New York, N.Y.
Smolens, Joseph Baum, 2147 Starling Ave., New York 61, N.Y.
Stuckman, Lorraine Elaine, 46 W. Goulson, Hazel Park, Mich.
Tilow, Gilda, 1570 Macomb's Rd., Bronx 52, N.Y.
Turnbull, Martha, 65 Third St., Los Altos, Calif.
Vagias, George James, 461 Audubon Ave., New York 33, N.Y.
Waldbauer, Eugene Charles, 6138 N. 4th St., Philadelphia 20, Pa.
Walsh, Michael John, 30-56 85 St., Jackson Heights, L.I., N.Y.
Welsh, Eleanor Jean, 1200 Edmonds Ave., Drexel Hill, Pa.
Whaley, Robert Grant, 260 Broadway, Lynbrook, L.I., N.Y.
Williams, Richard Ledru, 1611 Cleveland Blvd., Caldwell, Idaho.
Wilson, Audrey, 97 Tunnel Rd., Berkeley, Calif.

October 7, 1953

Alter, Audrey Jean, 906 N. 12th St., Manitowoc, Wis.
Baker, Suzanne, 840 Baker St., Wisconsin Rapids, Wis.
Baur, Janet Elsa, 2715 Eugenie Lane, Cincinnati 11, Ohio.
Bell, Letitia Lingle, Jordanville, N. Y.
Bolan, Dolores Grace, 1222 E. Crawford Ave., Milwaukee, Wis.
Coldwell, Maryann, 220 Alexander Ave., Port Edwards, Wis.
Gebert, Jeanne H., RR 1, Larwill, Ind.
Iesalins, Maiga, 12093 Martindale N., Detroit 4, Mich.
Jackels, Joyce Marie, 9424 Harding Blvd., Wauwatosa 10, Wis.
Kilian, Mary Ellen, 904 Main St., Black River Falls, Wis.
Kleiber, Joseph Keith, Rock, Mich.
Landis, Marilyn Jo, 111 W. North St., Worthington, Ohio.
Lehmberg, Sue Joseph, 204 Forest, Princeton, W. Va.
Marshall, Doreen Lois, 917 E. Dayton St., Madison, Wis.
McCarthy, Patricia Rita, 115 Wood St., East Palestine, Ohio.
Meyer, Barbara Ann, 1378 Villa Dr. N. E., Atlanta, Ga.
Poker, Dolores, 6615 N. River Rd., Milwaukee 9, Wis.
Reynolds, Gilbert R., Rt. 1, Wilmore, Ky.
Riviers, Betty Ruth, 428 Washington St., Sheboygan Falls, Wis.
Scott, John Peter, 1114 W. Oklahoma Ave., Milwaukee, Wis.
Smart, Donald W., 5353 N. High St., Worthington, Ohio.

Van Bree, Virginia Tatum, 1521 Ridgewood Ave. S. E., Grand Rapids, Mich.

October 8, 1953

Austin, L. Anthony, 3204 Hanes Ave., Richmond 22, Va.
Berman, Millard Lee, 422 King St., Portsmouth, Va.
Booz, Beverly Allison, 1201 W. Broadway, Hopewell, Va.
Bredehoft, Alice Anne, Millington, N. J.
Bruno, Richard Gilbert, 807 Lazelle St., Sturgis, S. D.
Coates, Blanche Fenton, 310 Druid Rd., Clearwater, Fla.
Currier, Dean P., 2227 Monument Ave., Richmond, Va.
Daniels, Katherine Pauline, Box 349, c/o Russell Chandler, Paintsville, Ky.
Davis, Doris, 2217 Lynhaven Ave., Richmond, Va.
DiFede, Salvatore Eugene Jr., 520 Main St., Roseto, Pa.
Erickson, Christine Katherine, 211 Denver Ave., Westmont, N. J.
Feimster, Peggy Ann, Olin, N. C.
Forrest, Jack Nathan, Odd, Va.
Gehris, Joseph Linington III, 1205 E. Wyomissing Blvd., Reading, Pa.
Gonzales Irizarry, Rosa B., 6120 43rd Ave., Hyattsville, Md.
Hannah, Lucille Lavern, Rt. 1, Franklin, N. C.
Henick, John Bernard Jr., 5904 W. Club Lane, Richmond, Va.
Jeffrey, Jackson Eugene, 610 Woodmere Rd., Interlaken, N. J.
Landen, Betty Ruth, 255 Union St., Springfield, Mass.
Laster, Ruby Nell, 776 S. 81st St., Birmingham, Ala.
McGaha, Lena Belle, Box 146, Newport, Tenn.
Moore, Elizabeth Elaine, 221 E. Brow Rd., Lookout Mountain, Tenn.
Parsons, Lois Beverly, PT Dept., Gallinger Municipal Hospital, Washington, D. C.
Plink, Bette Anne, 132 E. 54 St., New York 22, N.Y.
Pulizzi, Philip Nunzio, 246 Grampian Blvd., Williamsport, Pa.
Reedy, Robert Harold, 516 Pearl St., Yankton, S. D.
Sawyer, Arleigh Curtis, 3 Mill St., Westfield, Mass.
Scheyett, Walter Everett, 6120 43rd Ave., Hyattsville, Md.
Schmidt, William John, 26 Lexington Ave., Dumont, N. J.
Schwartzwalder, Wayne White, 1638 Rosecrest Ave., Richmond, Va.
Seiter, JoAnne Blanch, 1526 Lochwood Rd., Baltimore 18, Md.
Shearin, Elizabeth Ervin, Box 273, Darlington, S. C.
Sickels, Nancy E., 278 N. Midland Ave., Nyack, N. Y.
Taylor, Joseph Austin, 263 N. Maple Ave., East Orange, N.J.
West, Robert Lee, 2115 Brookside Rd., c/o J. H. Mitchell, Richmond, Va.
Wheeler, Lawrence Edgar, Med. Coll. of Virginia, Baruch Ctr. of Physical Medicine and Rehabilitation, Richmond 19, Va.
Winkler, Barbara E., 3704 Strathavon Rd., Shaker Heights 20, Ohio.
Zoltowicz, William J., 14 Preston Rd., Buffalo, N.Y.

October 15, 1953

Aaron, Frederick Lamar, 521 Weigel Dr., Ferguson, Mo.
Ambroson, Roger Dean, Leland, Iowa.
Anderson, John R., 119 Westlawn Pk., Iowa City, Iowa.
Bartges, Kent Mason, 321½ N. Center St., Corry, Pa.
Benson, Robert Leroy, Rt. 1, Box 52, South Holland, Ill.
Bowman, Bruce, 205 Stadium Park, Iowa City, Iowa.
Brown, Kenneth Earl, RR 2, Box 201, Bradford, Ohio.
Burgi, Donna Loree, 743 23rd St., Ogden, Utah.
Carleton, Richard Campbell, Box 486, Lodgepole, Neb.
Elkins, Dorothy LaVerne, 1011 Van Buren, Houston, Tex.
Ellsworth, Robert Wayne, Quadrangle B-219, Iowa City, Iowa.
Graham, Gerald Lloyd, 213 S. Madison, Iowa City, Iowa.
Hardy, John D., c/o W. W. Dupler, Fostoria Rd., Curtice, Ohio.
Hoberg, Jack Richard, 3000 Center St., Sioux City 3, Iowa.
Jackson, Marjorie Lee, 2305 Bonita Dr., Austin, Tex.
Jones, Ervin Burman, Hawkeye Vill. No. 124, Iowa City, Iowa.
Lane, Phyllis Ruth, Box 188, Westlawn, Iowa City, Iowa.
Madden, John Avon, 1600 Louisiana St., Houston, Tex.
McCutcheon, Ishuan Regina, c/o Coordinator of Crip. Child. Serv., Dept. of PH, Kern County, Bakersfield, Calif.
Mendelson, Stanley, 268 Hale St., New Brunswick, N.J.
Moore, Betty Louise, Gunnison, Colo.
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October 20 1953

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PHYSICAL MEDICINE ABSTRACTS

Footrest Device for Exercising of the Lower Extremities by Bedridden Patients. Joseph O. Smigel, and John H. Gibson.

J.A.M.A. **150**:587 (Oct. 11) 1952.

The authors have constructed an apparatus that provides a means of exercising the feet and legs, can act as a footrest for comfort, and yet can be slid out of the way by the patient when not in use. It consists of a 12 inch length of 1½ inch hard rubber tubing padded with cellucotton to three inches and covered by stockinet, and a length of sash cord. The sash cord is passed through the rubber tube and is of sufficient length to be tied to the springs on both sides of the bed, approximating the patient's hips, and leaving the footrest in a position comfortable for the patient. Thus, the patient is able to roll and push it on the bed approximately three to four inches. He can use the toes or heels to obtain support or to bring into play the various leg muscles. The length of travel will be determined by the thickness of the mattress; also, the mattress will give a certain amount of resistance to the exerciser. This is a very practical, cheap combination exerciser and footrest, and should prove an important means of proving much needed exercises for bed patients.

Rehabilitation of the Cardiac: A Report on the Findings Made During A Three Year Observation Period at the Altro Workshops, Inc. Abraham Jezer.

Am. J. Phys. Med. **31**:139 (June) 1952.

The rehabilitation in the Altro Workshop project for cardiacs has been conducted for a three year period. Admitted to the Workshop were those patients whose cardiac classification was 2C and 3C, totalling 30 who had hypertensive arteriosclerotic heart disease, and 12 who had rheumatic or congenital heart disease. The result of this study seems to warrant the following tentative conclusions: (1) For the rheumatic group, the findings indicate that the rheumatic recently recovered from subacute bacterial endocarditis or from active rheumatic carditis and those showing chronic rheumatic heart disease without congestive heart failure may carry on full time employment at a sedentary occupation. Those showing a regular rhythm and heart failure or permanent auricular fibrillation require a permanently sheltered workshop; (2) the hypertensive and arteriosclerotic cardiac patients who show no evidence of heart failure may continue to work at their normal occupation. Those showing mild heart failure which can

be controlled by mercurials, digitalis, and a salt-poor regimen, may also continue working in an accustomed job, providing it is not strenuous. A modified rest regimen should be followed during week-ends; (3) the hypertensive and arteriosclerotic having angina controlled by nitroglycerine may continue to work at an accustomed job. Retraining at a less exacting job for these patients is socially impractical, unless the accustomed job is too strenuous. Those showing both angina and heart failure are usually quite disabled and should be permitted to work in a permanently sheltered workshop; (4) for the elderly cardiac who cannot continue being employed full time at an accustomed job, a permanently sheltered workshop is urgently required, and (5) the major difficulty in the restoration to work of many cardiac cripples is created by the frightening approach to heart disease shown by some attending physicians. Such cardiacs are more disabled by emotional instability caused by the impact of the diagnosis of heart disease than by the effects of heart disease itself. For these, cardiac rehabilitation rather than retraining or a permanently sheltered workshop is required. Indoctrination of physicians in the psychological management of their cardiac patients is essential for progress in this field.

Ultrasonic Therapy in the Treatment of Hypertrophic Arthritis in Elderly Patients. John H. Aldes, and Walter J. Jadeson.

Ann. West. Med. & Surg. **6**:545 (Sept.) 1952.

This investigation of ultrasonics was concerned only with the practical and clinical application of the new procedure. The aim was to relieve pain, and to effect the greatest possible measure of rehabilitation in geriatric patients. Where the authors succeeded, they speak of "improvement." They feel that in order to claim a "cure," they should show permanent relief from symptoms over a longer period of time, which at present they are unable to do. Their evaluation is necessarily subjective, since they had to depend largely upon the statements of their patients.

The objective finding was an increase in range of motion of the affected area. Undoubtedly, this was due to ultrasonic therapy with its powerful deep micromassage which increases intracellular metabolism, loosens adhesions, relieves localized congestion, and induces absorption of exudates and precipitates. Generally, patients reacted favorably to ultrasonic therapy, but relief did not occur until a series of irradiations had been given. It would seem, therefore, that accumulation of irradiation constitutes an important element in eliciting a favorable response. Although improvement was not obtained in all of the 311 cases treated, none of the patients suffered any negative effects. It should be emphasized that this is a report on the use of a new procedure for a chronic condition in geriatric patients who had not received relief from previous conservative treatment. The results have been encouraging, but more extensive clinical studies must be carried out before definitive conclusions can be made. However, it seems that ultrasonic radiation may in time become a valuable adjunct to accepted methods of medical therapy in the treatment of arthritis.

Orthopedic Management, Including Bracing, in Poliomyelitis. Atha Thomas.

Am. J. Phys. Med. **31**:272 (Aug.) 1952.

Orthopedic management of poliomyelitis begins with the acute onset of the disease and extends throughout the course of treatment until maximum recovery is reached. Special attention is directed to the prevention of deformity and restoration of function. The abnormal forces which lead to deformity are described in some detail and procedures outlined that can be utilized to overcome such deforming forces and thus prevent, insofar as possible, many of the permanent crippling conditions that are so disabling in poliomyelitis. Muscle reeducation and gait training are continued as long as there is evidence of improvement. A word of warning about depending too rigidly upon the muscle evaluation or "muscle chart" is in order. Even though repeated tests of individual muscles fail to show any improvement over a period of time, yet the patient as a whole often does continue to improve as far as efficiency of gait and ability to handle himself are concerned. He accomplishes this through more efficient use of remaining muscles, by "substitution," and by a general adaptation and adjustment to his handicap. At times such adjustment is quite phenomenal and is aided by continued instruction and training. There is always hope for improvement in infantile paralysis, and persistence, courage, and optimism often lead to results that may be surprising.

Mechanical Aid for the Arm Amputee. Jerome Weiss, and Otto Eisert.

J.A.M.A. **149**:1470 (Aug. 16) 1952.

Although recent developments in prosthetic devices have done much to restore the usefulness and to elevate the morale of the arm amputee, there remain two important functions that still are difficult for him. These are the opening of an ordinary can, and the removing or replacing of a bulky top from a jar. A simple device to make this chore safe

and easy for the one-armed amputee or hemiplegic has been developed by the physical medicine rehabilitation service of the Brooklyn Veterans Administration Hospital. It is an adaptation of the saddler's bench, in which foot power is used to clamp the leather and hold it while it is being stitched. Many modifications in construction are possible, but the simple form of the device can be produced in three or four hours in the manual arts or occupational therapy departments of any good service of physical medicine and rehabilitation. The amputee or hemiplegic will be able to use the holder perfectly with only brief instruction; with a little practice, he usually can do better than an able-bodied person can do without the holder.

Mechanical Aids to Treatment Made in Occupational Therapy Workshops. Mary S. Jones.

Brit. J. Phys. Med. **15**:153 (July) 1952.

This article describes a boned glove for patients with median-nerve paralysis, a working gauntlet for hand amputees, rockers for application to walking plasters, together with wooden soles to raise the shoe on the other foot to equalize the length of the legs, working pylons for above- and below-knee amputees, and details of the ways in which these various aids may be utilized. The patients themselves aided greatly in the design and manufacture of these various mechanical aids. Some of them were not interested in anything for themselves, but became completely absorbed when asked to help design and make an aid for another patient, and thereby exercised and utilized the various muscles for which they were being treated. It is emphasized that work of this nature should always be available in an occupational therapy workshop to engage the interest of the skilled patient.

Disseminated Sclerosis. M. D. Rawkins.

Brit. J. Phys. Med. **15**:178 (Aug.) 1952.

As with other demyelinating diseases, there is no medical treatment which will affect the course of disseminated sclerosis. The aim must be to prevent exacerbations rather than to attempt to improve established symptoms (except, perhaps, by physical therapy), as the destruction of axis cylinders, which can always be demonstrated in the chronic lesion, is not a reversible process. Although many types of treatment have been tried, the treatment at present consists of assisting the patient to maintain a high-level of general physical health and to avoid emotional and mental stress. Physical therapy has been of great value in helping rehabilitation.

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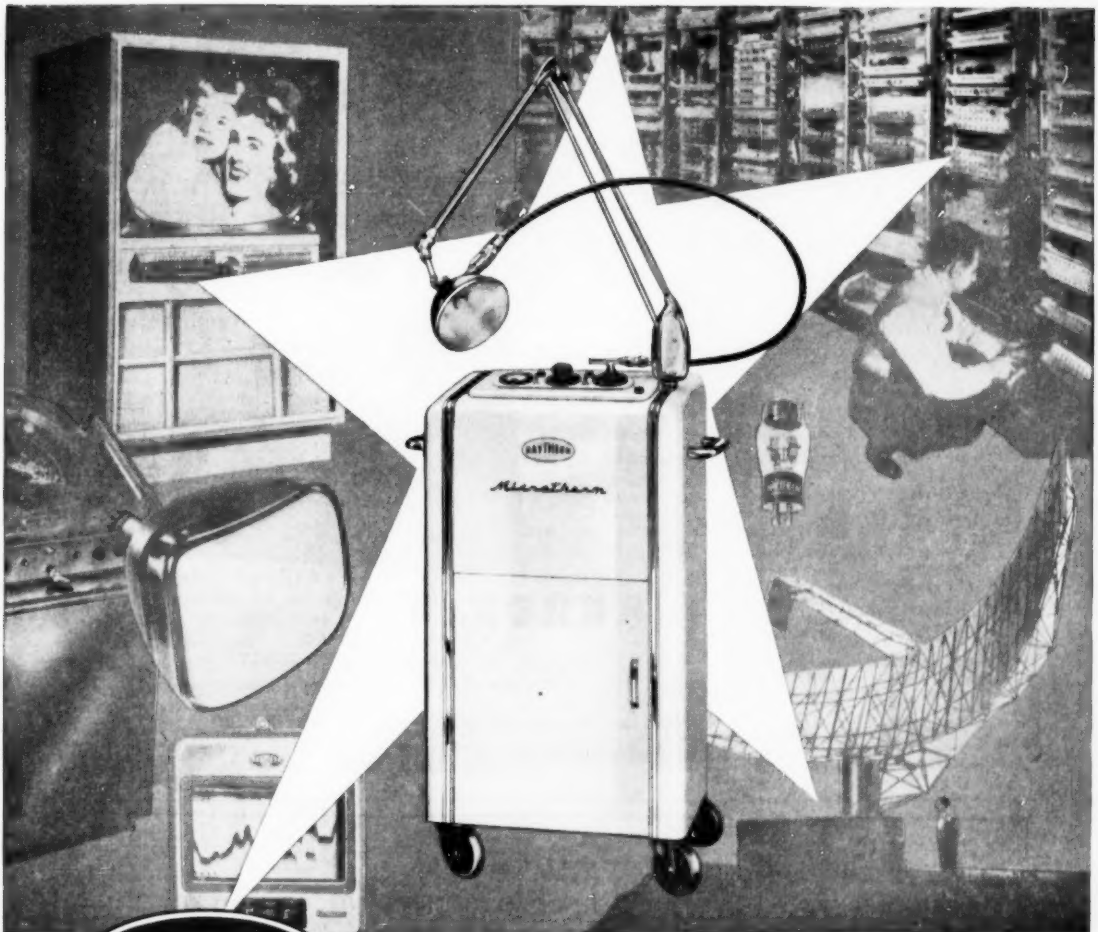
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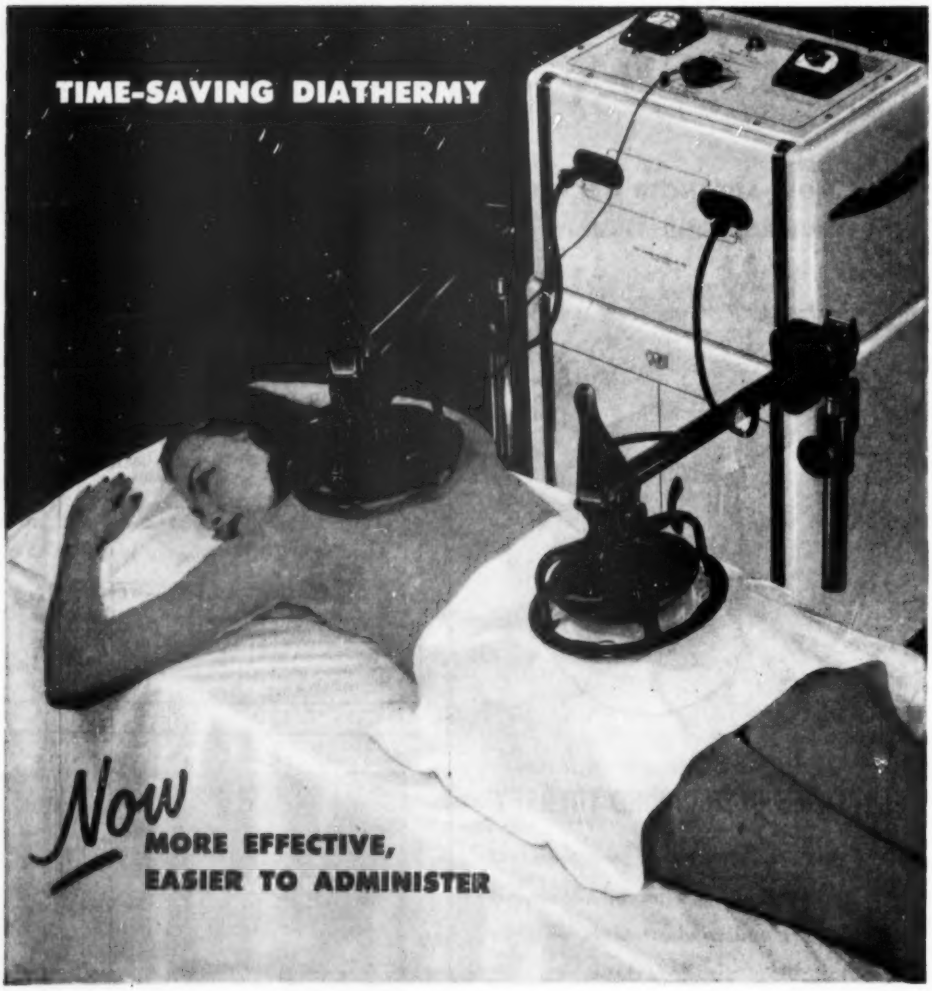
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4. The essay must not have been published previously.

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